(13)

No. 105, ORIGINAL

In The

Supreme Court of the United States

October Term, 1985

STATE OF KANSAS,

Plaintiff,

v.

STATE OF COLORADO,

Defendant,

and

UNITED STATES OF AMERICA,

Defendant-Intervenor.

ARTHUR L. LITTLEWORTH, Special Master

REPORT

VOLUME I

July 1994

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ABBREVIATIONS AND GLOSSARY

1.	Reporter's Transcript	RT Vol. at ___
2.	Exhibits of Parties, and Joint Exhibits	Kan. Exh. ___ Colo. Exh. ___ U.S. Exh. ___ Jt. Exh. ___
3.	Post-Trial Briefs	
	(a) Kansas' Post-Trial Opening Brief	Kan. Opening Br. at ___
	(b) Colorado's Closing Brief re Kansas' Well Claim	Colo. Closing Well Br. at ___
	(c) Colorado's Closing Brief re Kansas' Winter Water Storage Claim	Colo. Closing WWSP Br. at ___
	(d) Amended Trial Brief of the United States on Kansas' Winter Water Storage Program Claim	U.S. WWSP Br. at ___
	(e) Kansas' Post-Trial Answer Brief	Kan. Answer Br. at ___
	(f) Colorado's Response to Kansas' Post-Trial Opening Brief	Colo. Response Br. at ___

ABBREVIATIONS AND GLOSSARY – Continued

(g)	Amended Response Brief of the United States on the Kansas Winter Water Storage Claim	U.S. Response Br. at ___
(h)	Kansas' Post-Trial Reply Brief.	Kan. Reply Br. at ___
(i)	Colorado's Reply Brief	Colo. Reply Br. at ___
(j)	Reply Brief of the United States on the Kansas Winter Water Storage Claim	U.S. Reply Br. at ___
(k)	Colorado's Memorandum re Matters to be Raised at Oral Argument	Colo. Oral Argument Memorandum at ___

4.	Acre-foot	AF, a volume of water one foot deep over one acre in area; equal to 325,900 gallons.
5.	Cubic feet per second	cfs, a rate of flow equal to 7.48 gallons per second, or 1.983 acre-feet per day.
6.	Evapotranspiration	ET, loss of water from soil by evaporation and by transpiration from plants growing thereon.

ABBREVIATIONS AND GLOSSARY – Continued

7.	Gallons per minute	gpm
8.	Hydraulic conductivity	The volumetric rate at which water will pass through a unit cross-sectional area of an aquifer under a given hydraulic gradient.
9.	Kilowatts (1,000 W)	kW
10.	Kilowatt hours	kWh
11.	Million acre-feet	MAF
12.	Potential evapotranspiration	PET
13.	Saturated zone	Portion of the geologic profile below the groundwater table, in which the pores or voids between the soil particles are filled with water.
14.	Specific yield	A measurement of the volume of water that will drain by gravity from a unit of saturated soil.

ABBREVIATIONS AND GLOSSARY – Continued

15.	Transmissivity	A quantitative measurement of the groundwater that will move through the full saturated thickness of the aquifer. Calculated as the hydraulic conductivity of the aquifer times the saturated thickness under a given hydraulic gradient.
16.	Unsaturated zone	Portion of the geologic profile above the groundwater table, or the saturated zone. The pores or voids between the soil particles may have both air and water in them.
17.	United States Geological Survey	USGS
18.	Winter Water Storage Program	WWSP

REPORT – PART I

PRIMARY REPORT ON LIABILITY ISSUES

SECTION I

INTRODUCTION

Like many rivers in the West, the upper reach of the Arkansas has been beset by decades of controversy. Twice before in this century, the States of Kansas and Colorado have litigated in the Supreme Court.[1] In the early years numerous suits were also filed among private water users in the two states.[2] Yet none of these legal actions successfully settled the basic issue of how the Arkansas River should be apportioned between the two states. Nor did the 1949 Arkansas River Compact achieve the lasting peace sought by those who negotiated that agreement, even though it was approved by the legislatures and governors of both states, as well as by the Congress of the United States.[3]

The settlement of Kansas, which was admitted to the Union in 1861, commenced before that in Colorado. It was not until 1876 that Colorado became a state. By the 1870s, the transformation of prairie grasslands in Kansas

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[1] *Kansas v. Colorado*, 206 U.S. 46, 51 L.Ed. 956, 27 S.Ct. 655 (1907); *Colorado v. Kansas*, 320 U.S. 383, 88 L.Ed. 116, 64 S.Ct. 176 (1943).

[2] See Kan. Exh. 129, Vol. I at 31-38, describing numerous actions within Kansas, and between Kansas and Colorado water users.

[3] Of the first seven members appointed to the body charged with administering the compact, five had served on the commission that negotiated the compact.

into irrigated farms and small towns was well underway. Kan. Exh. 129, Vol. I at 17. Kansas alleged in its first suit against Colorado that by 1883 practically all of the bottom lands of the Arkansas Valley in Kansas, were in a state of "successful and prosperous cultivation in reliance upon the waters of the Arkansas River" *Kansas v. Colorado*, 206 U.S. 46 at 51, 51 L.Ed. 956, 27 S.Ct. 655 (1907).

Prior to 1885, Colorado users took "comparatively little water" from the Arkansas River for irrigation purposes. *Id.* at 107-108. However, development in Colorado came rapidly with the construction of large irrigation canals and storage facilities. Kansas alleged that by 1901 Colorado users were diverting "all the natural and normal waters and a large portion of the flood waters" of the Arkansas River. *Id.* at 52.

The 1901 action was the first interstate water controversy heard by the Supreme Court. Initially, the Court's jurisdiction was challenged, but a demurrer on that basis was overruled. Moreover, the Court determined that Kansas could properly represent the interests of its citizens. *Kansas v. Colorado*, 185 U.S. 125, 46 L.Ed. 838, 22 S.Ct. 552 (1902).[4] Substantively, Kansas contended that nonriparian arid lands were being irrigated in Colorado, and that under English common law Kansas was entitled to receive the flows of the Arkansas River as they existed "before any human interference." *Kansas v. Colorado*, 206 U.S. 46 at 85, 98. Colorado, on the other hand, claimed the right of its users under Colorado appropriative doctrine

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[4] The jurisdictional issue was further considered in *Kansas v. Colorado*, 206 U.S. 46 at 80-85, 51 L.Ed. 956, 27 S.Ct. 655 (1907).

to take all of the streamflow, without regard to any downstream impact in Kansas. *Id.*

Not surprisingly, the Supreme Court rejected both of these extreme positions. Instead it ruled that the dispute should be adjusted ". . . upon the basis of equality of rights as to secure as far as possible to Colorado the benefits of irrigation without depriving Kansas of the like beneficial effects of a flowing stream." *Id.* at 100. This was the first expression of the doctrine of equitable apportionment of benefits in regard to interstate streams.

Reviewing the evidence in this early case, the Court found that the diminution of flow caused by Colorado irrigation had worked some detriment to Kansas, but comparing that detriment to the benefits in Colorado, the Court concluded ". . . it would seem that equality of right and equity between the two states forbids any interference with the present withdrawal of water in Colorado for purposes of irrigation." *Id.* at 114. The Court cautioned, however, that "it is obvious that if the depletion of the waters of the river by Colorado continues to increase there will come a time when Kansas may justly say that there is no longer an equitable division of benefits, and may rightfully call for relief against the action of Colorado, its corporations and citizens, in appropriating the waters of the Arkansas for irrigation purposes." *Id.* at 117.

It was Colorado however, not Kansas, that next brought the ongoing dispute back to the Supreme Court. In 1928 Colorado filed a bill in equity seeking to protect the rights established by the earlier decree, and to enjoin further prosecution of suits between water users in the

two states. That action was not decided by the Supreme Court until 1943. *Colorado v. Kansas*, 320 U.S. 383, 88 L.Ed. 116, 64 S.Ct. 176 (1943). A Master appointed to take evidence found that indeed there had been a material increase in river depletions caused by use in Colorado since the first Supreme Court decision. 320 U.S. at 391. Accordingly, he recommended a specific apportionment of the dependable flows of the river, namely, five-sixths to Colorado and one-sixth to Kansas. *Id.* at 390.

Once again, however, Kansas was turned away. The Supreme Court rejected the Master's finding that Colorado's use had materially increased,[5] as well as his recommendation for a specific allocation of flows. The only relief granted was to enjoin the private litigation. The Court explained its cautious approach in these words:

> "The reason for judicial caution in adjudicating the relative rights of states in such cases is that, while we have jurisdiction in such disputes, they involve the interests of quasi-sovereigns, present complicated and delicate questions, and,

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[5] George S. Knapp, Chief Engineer of the Kansas Division of Water Resources, complained that the Supreme Court was mistaken in its conclusion that Colorado diversions had not changed since 1907. Knapp thought the Court had relied on a table in the Colorado brief showing a decrease in diversions between 1912-15 and 1931-40 from 1,145,000 acre-feet annually to 877,000. However, he claimed that the records of Colorado's own state engineer demonstrated an increase. See Kan. Exh. 129, Vol. I at 166-67. By way of comparison, Colorado in the present case computed average diversions for 1950-85 at 884,881 acre-feet annually, with some high years exceeding 1,400,000 acre-feet. Colo. Exhs. 838, 839. These surface diversion figures do not include pumping, although they do include transmountain imports.

> due to the possibility of future change of conditions, necessitate expert administration rather than judicial imposition of a hard and fast rule. Such controversies may appropriately be composed by negotiation and agreement, pursuant to the compact clause of the Federal constitution. *We say of this case, as the court has said of interstate differences of like nature, that such mutual accommodation and agreement should, if possible, be the medium of settlement, instead of invocation of our adjudicatory power."* *Id.* at 392, emphasis added.

Against the background of this second Supreme Court decision, and the urgent need to develop operating principles for the storage of water in the newly constructed John Martin Reservoir,[6] the states renewed their efforts to negotiate an interstate compact.[7] After some

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[6] Construction of John Martin Reservoir began in 1939 and was sufficiently completed to permit limited storage in 1942. Jt. Exh. 129 at 47. Gen. Kramer reported that the reservoir had an original storage capacity of approximately 700,000 acre-feet. It is located on the mainstream about 58 miles upstream from the Colorado-Kansas border. The upper 280,000 acre-feet of storage capacity was initially allocated to flood control, with the remaining 420,000 acre-feet assigned to water conservation. Jt. Exh. 15 at 33.

[7] In 1921 and 1923 the legislatures in both states had authorized the appointment of commissioners to negotiate an interstate compact. Colorado named Delph E. Carpenter, a highly respected Colorado lawyer who had initiated the compact effort. Kansas selected George S. Knapp, then its Irrigation Commissioner. These two men drafted a tentative Arkansas River Compact which was submitted in 1925 to irrigation interests in both states for their comments. However, opposition developed and the proposed compact was never ratified. Kan. Exh. 129, Vol. I at 39-45.

three years of formal negotiations, the Arkansas River Compact was finally completed and approved in 1949. Pursuant to Article IX-A the compact became effective upon ratification by each state legislature and consent by Congress. 1949 Colo. Sess. Laws 485, § 1, codified at C.R.S. § 37-69-101 (1973); 1949 Kan. Sess. Laws 829, codified at Kan. Stat. Ann. § 82a-520; Act of Congress of May 31, 1949, 63 Stat 145. A copy of the compact is included as Exhibit 1 in the Appendix.

The compact recites that its major purposes are to settle existing disputes, to remove causes of future controversy, and to "Equitably divide and apportion" the waters of the Arkansas River, "as well as the benefits arising from the construction . . . of John Martin Reservoir." Articles I-A, I-B. The compact does not allocate to Kansas either a defined quantity of Arkansas River water, or a specific share of the river flow.[8]

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[8] The lack of a specific allocation was not an issue before Congress. Support there for the compact was universal and enthusiastic. Gen. Hans Kramer, the United States representative on the Compact Negotiating Commission, and its chairman, reported that both states had sought ". . . to attain a definitive solution to their perennial problem of apportionment of the waters of the Arkansas River." Jt. Exh. 15 at 33. He was of the firm conclusion that the compact provided a "fair, constructive, and workable solution" to the controversy. *Id.* at 36. He went on to pay tribute to the compact commissioners:

> "It has been an unusual experience to participate in these negotiations. To my knowledge they have been of a different character from most interstate compacts in that they have been preceded by this long history of litigation, so that the compact commissioners, you might say, came into the arena wearing gloves, ready to continue slugging. But fortunately, as has been

With respect to this case, one of the key provisions of the compact is found in Article IV-D. It states that the compact is not intended to prevent future development of the Arkansas River Basin in Colorado by either federal or state agencies, or by private enterprise, which may involve the construction of dams, reservoirs and other works, ". . . Provided, that the waters of the Arkansas River . . . shall not be materially depleted in usable quantity or availability for use to the water users in Colorado and Kansas under this Compact by such future development or construction."

Administration of the compact is vested in the Arkansas River Compact Administration, which consists of three representatives from each state, appointed by their respective governors. Articles VIII-A, VIII-C. A representative of the United States is an ex-officio member, who acts as chairman but has no vote. Article VIII-C. The compact administration can act only with full agreement. It provides that each state shall have but one vote, and every action of the Administration "shall require unanimous vote." Article VIII-D. The requirement for continued agreement between the two states appears not to

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testified to here by the representatives of both States, that attitude did not continue very long and we were fortunate in clearing the atmosphere of all the prejudice and awkwardness that goes with a long history of litigation.

"The commissioners approached this matter in a fair-minded way. They were men of good will, good intent, and of good faith. I think their work is a monument to that approach and to that philosophy. It is, to my mind, a fine example of the way interstate arguments ought to be settled." *Id.* at 37.

have been a problem in the early years. But changing conditions along the river gradually began to erode the early promise of the compact.

In the years following approval of the compact, farmers in Colorado constructed a large number of new wells along the Arkansas River.[9] These wells were used generally to supplement surface diversions delivered through the various canal companies. RT Vol. 66 at 32-34; Jt. Exh. 157 at 10. Through the use of wells, farmers could better time the availability of their water supplies and grow higher value crops. RT Vol. 66 at 32-33, 46. No one questions the fact that these wells depleted river flows, perhaps more slowly than the canal companies' surface diversions, but with the same inevitability. Jt. Exh. 157 at 11; Jt. Exh. 78; RT Vol. 76 at 56; RT Vol. 30 at 59; *Kuiper v. Atchison, Topeka & Santa Fe Ry. Co.*, 195 Colo. 557, 581 P.2d 293 at 294-95 (1978).

During the period when most of the new wells were constructed,[10] Colorado required either no prior state

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[9] In a 1968 study, the United States Geological Survey ("USGS") reported there were 1,348 "large-capacity" irrigation wells located in the valley fill aquifer along the river in Colorado. Jt. Exh. 66 at 2. Groundwater in this aquifer is in hydraulic continuity with the mainstem of the river, and the surface flows and groundwater constitute a common supply. Pumping increased, according to this study, from 31,000 to 185,000 acre-feet annually in the period 1950 to 1965. *Id.* at 5. Another USGS report puts the 1964 well production at 230,000 acre-feet. Jt. Exh. 74 at 20.

[10] Of the 1,348 large irrigation wells found in 1968, the USGS reported that about 1,000 had been constructed between 1950 and 1965. Jt. Exh. 66 at 1. It was not until 1965 that

approval at all or, after 1957, only a ministerial permit. Subsequent efforts by the legislature and the Colorado state engineer's office to control well production and to bring these wells under the state's statutory appropriation system ran into strenuous opposition. The success of the various attempts at control were limited at best.

In the 1970s the United States also completed construction of two more large dams and reservoirs in Colorado. Pueblo Reservoir, finished in 1975, is located on the mainstem of the Arkansas shortly after it emerges from the Rocky Mountains. Trinidad Reservoir is situated on the Purgatoire River, the main tributary of the Arkansas in Colorado, and was completed in 1976. Storage in each of these reservoirs has become an issue in this case.

By the early 1980s, Kansas began its own investigation of possible compact violations arising from the impact of postcompact wells and the operation of the two federal reservoirs (Pueblo and Trinidad) on the river flows reaching Kansas. Colorado concedes that during the 1970s postcompact pumping caused a decline in Stateline flows,[11] although on several grounds Colorado

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Colorado first attempted to regulate groundwater production, and that initial effort was struck down by the Colorado Supreme Court. *Fellhauer v. People*, 167 Colo. 320, 447 P.2d 986 (1968). Colorado acknowledges that most of the postcompact wells were drilled in the 1950s and early 1960s. Colo. Closing Well Br. at 13. See also Colo. Exh. 165*, Table A.1.

[11] Colo. Opening Statement, RT Vol. 59 at 16; Colo. Closing Well Br. at 11, 19. The spelling of "Stateline," capitalized and used sometimes as a noun and at other times as an adjective, fits none of the traditional rules. However, this spelling and use appears in the compact itself and has been consistently adopted by the parties, so it is used here.

disputes the right of Kansas to a larger share of river flows. RT Vol. 81 at 155-56; RT Vol. 84 at 42; RT Vol. 115 at 62; RT Vol. 66 at 128-29, 132. After making a formal complaint to the Arkansas River Compact Administration, Kansas came to believe that the unanimous vote requirement of the compact would continue to thwart any administrative relief. Kansas thus turned back to the Supreme Court, filing this action in December 1985.

SECTION II

STRUCTURE OF THE REPORT AND RECORD

This Report embraces my findings and recommendations following completion of the liability phase of the trial. The remedy issues, including damages, were severed pending a final determination on liability. The Report is comprised of five parts. Part I is the primary post-trial Report. Parts II, III, IV and V represent substantive decisions made earlier during the course of trial but which, with the approval of the parties, have been held for Supreme Court review until now. Part II is my decision, subject to confirmation of the Court, to grant Colorado's motion for partial summary judgment on the legal issue of whether the Winter Water Storage Program in Pueblo Reservoir was subject to the approval of the Arkansas River Compact Administration. Part III is my decision, subject to confirmation of the Court, to dismiss the Kansas claim arising from the operation of Trinidad Reservoir. Parts IV and V include my decisions, subject to confirmation of the Court, to dismiss the two Colorado counterclaims.

A separate Appendix is also provided. The Appendix includes certain other decisions and orders, important to the conduct and outcome of the trial, but not in and of themselves determinative of final substantive issues. These include my denial of Colorado's motion to stay and to return certain issues to the Arkansas River Compact Administration for failure to exhaust administrative remedies (Exhibit 5); my order granting Kansas' motion to bifurcate the trial into liability and remedy phases (Exhibit 6); my order governing discovery procedures for

expert witnesses and certain other pre-trial matters and the amendment thereto (Exhibit 7); my order concerning the conduct of the trial following the disability of Kansas' chief technical expert (Exhibit 8); and my order on the admissibility of Dr. Dracup's notes (Exhibit 9). Numerous other orders were issued on various discovery and evidentiary issues. These are not included in the Appendix, but may be found in the record if the parties should take exception to any of them.

The Appendix also includes copies of the amended pleadings on which the case was tried (Exhibits 2, 3, and 4), as well as certain key exhibits. Other items in the Appendix are noted as they appear in the text.

The record (apart from exhibits and the reporter's transcript) has been maintained in two separate files. The first consists of 26 volumes, and includes all pleadings, motions, briefs, decisions, orders and discovery documents. A comprehensive index and an index within each volume have been prepared for these documents. The second file is comprised of 12 volumes and includes all of the correspondence with and among the parties, and occasionally others. All documents in both files have been date-stamped and filed chronologically.

The reporter's transcript consists of 143 volumes through oral argument on my Draft Report, with a separate volume for each day of trial. Initially the transcripts were numbered with Roman numerals only. But this system became increasingly cumbersome as the trial lengthened. Arabic numerals were then substituted, and these have been used in the citations to the record. The reporter's transcript is cited in this Report as "RT Vol. 88 at

105." Each volume of the transcript includes an index identifying the witnesses who testified, and any exhibits admitted into evidence, including appropriate page references. Certain corrections to individual transcripts were made pursuant to stipulations of the parties and by my orders dated January 5, 1994 and March 11, 1994. These are included in Appendix Exhibits 12 and 13, respectively, and a copy of the pertinent order is included in each affected transcript.

Exhibits have been divided into four groups: those submitted by Kansas, by Colorado, by the United States, and the joint exhibits. Each exhibit is contained in a separate folder, except for certain "unique" exhibits such as large mounted maps. The exhibit folders occupy 29 boxes, which have been labeled to show the particular exhibits inside each box. Throughout the trial a number of exhibits were revised, and these are identified with an asterisk following the exhibit number. In some cases more than one revision has occurred and these exhibits will carry more than one asterisk. For example, Kan. Exh. 111*** has undergone a minimum of three revisions.[12] Where revisions have been made, the exhibit folder contains the original form of the exhibit and all of the revisions admitted into evidence. Revisions not admitted, and all exhibits not offered or rejected, are included in a single box and so identified. Some exhibits were lodged with me before trial but were not offered into evidence. These have been retained with my bench copies, and have not been included in the 29 boxes of exhibits.

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[12] Some early revised exhibits were also identified with a date, e.g., Kan. Exh. 111* (12/6/90).

A complete Record of Exhibits has also been prepared. This identifies each exhibit by number, the offering party (or joint exhibit), the date when it was first identified in the trial, the witness or witnesses testifying to the exhibit, and the date of its admission into evidence. Since the reporter's transcripts are all dated, one can easily locate the testimony concerning any particular exhibit.

A final joint exhibit list has also been filed by counsel, a copy of which is included in the first box of joint exhibits. Not all of the joint exhibits on this final list, however, were offered into evidence.

SECTION III

PROCEDURAL HISTORY

A. Pleadings.

Kansas filed its motion for leave to file a complaint, the complaint itself, and a brief in support of the motion on December 16, 1985. The State of Colorado was named as the sole defendant. The complaint alleged that the Arkansas River is an interstate stream and the subject of a 1949 compact, made between the States of Kansas and Colorado and approved by the United States Congress. Kansas charged that the State of Colorado and its water users had materially depleted the usable and available Stateline flows of the Arkansas River in violation of the compact. Specifically, Kansas alleged that Stateline depletions were caused by postcompact wells in Colorado which annually pumped approximately 150,000 acre-feet of groundwater related to flows in the Arkansas River.

Kansas also alleged that Colorado had blocked an administrative investigation by the Arkansas River Compact Administration into Colorado's compact violations. The compact provides that all actions of the compact administration must be by unanimous vote, each state having one vote. The compact administration is chaired by the United States representative, but the United States has no vote. According to the Kansas complaint, the alleged violations which Kansas put before the compact administration included: the impact of postcompact wells; the operation of Trinidad Reservoir located on the Purgatoire River, a main tributary of the Arkansas River; the consequences of future increases in the consumption

of return flows from water imported by Colorado into the Arkansas River Watershed; and Colorado's rejection of a 1951 resolution of the Arkansas River Compact Administration allegedly requiring that any storage of the native waters of the Arkansas River be approved by the compact administration. This last issue related to Pueblo Reservoir located on the mainstem of the Arkansas, and the operation of the so-called Winter Water Storage Program in that reservoir.

The prayer of the original complaint sought a decree commanding Colorado, its officers, citizens and political subdivisions to deliver the waters of the Arkansas River in accordance with the provisions of the compact.

Colorado responded on February 18, 1986 by filing a brief in opposition to the Kansas motion. Essentially, Colorado argued that Kansas had failed to demonstrate that an investigation by the Arkansas River Compact Administration would not be an adequate means of vindicating the allegations of compact violations. Colorado claimed there was substantial disagreement over the issue of postcompact well development in Colorado, and whether such development had materially depleted Stateline flows in violation of the compact. Premature invocation of the Supreme Court's jurisdiction, argued Colorado, would deny the Court the benefit of the special expertise and abilities of the compact administration in addressing these complex hydrologic issues. Moreover, Colorado asserted that the compact administration was not "deadlocked or unable to act," but had been proceeding in a cooperative manner to conduct the necessary investigation. Colo. Brief in Opposition at 8.

Before the Supreme Court ruled, however, Kansas filed a new motion, for leave either to file its original complaint, ". . . or, in the alternative, that the court order the State of Colorado to comply with Article VIII(H) of the Arkansas River Compact . . . to promptly investigate all of Kansas' allegations of Compact violation." Kan. Motion for Leave to File Complaint, Mar. 3, 1986, p. 8. Briefs were then filed by both states on the original Kansas motion for leave to file its complaint, or in the alternative, to compel an administrative investigation by the Arkansas River Compact Administration. The Kansas brief outlined in further detail the efforts made within the compact administration, and the alleged frustration of the administrative procedure.

On March 24, 1986, without further argument, the Court issued the following order:

> "The motion for leave to file a bill of complaint is granted. Defendant is allowed sixty days within which to file an answer." 475 U.S. 1079, 89 L.Ed.2d 712, 106 S.Ct. 1454 (1986).

On May 22, 1986 Colorado filed its answer and counterclaim to the Kansas complaint. Colorado denied the allegations of compact violations, and asserted several affirmative defenses. Colorado again alleged that Kansas had failed to exhaust its administrative remedies under the compact, and that its claims were barred by laches and other equitable doctrines. It also alleged that irrigated acreage in Colorado had declined since adoption of the compact, while irrigation in Kansas had increased. Colorado charged that Kansas was seeking to have the Court rewrite the Stateline delivery obligations of the

compact so as to maintain this postcompact Kansas economy. Colorado further alleged that transmountain imports from the western slope of the Rocky Mountains were not subject to the compact nor any claim of Kansas. Finally, Colorado alleged that the Winter Water Storage Program in Pueblo Reservoir was not subject to approval by the compact administration, and that Kansas was barred from asserting such claim by virtue of a 1980 Operating Plan adopted by the compact administration and the benefits received by Kansas under this plan.

Colorado also asserted two counterclaims: (1) that Kansas had stored water released from John Martin Reservoir in violation of the compact; and (2) that wells in Kansas had depleted the supply of surface water available to Kansas users, and had thus caused Kansas to make additional demands for releases of water stored in John Martin Reservoir in Colorado, to the detriment of Colorado users. Kansas' reply to Colorado's counterclaim was filed on June 11, 1986.

On February 24, 1989, with leave of the Supreme Court, Kansas filed a motion to supplement the allegations in its original complaint. In addition to charging compact violations of Articles IV-D and V-F, Kansas sought to add violations of Articles V-E(3), V-E(4) and V-H(2). Colorado opposed the amendment. The United States, which by then had intervened, took no position since no federal interests were involved.

On May 19, 1989, Kansas filed a second motion to amend its complaint by adding claims for both general and special damages. This motion was based upon the Supreme Court decision in *Texas v. New Mexico*, 482 U.S.

124, 96 L.Ed.2d 105, 107 S.Ct. 2279 (1987), in which for the first time damages were allowed as a remedy for breach of an interstate compact. Colorado did not oppose the amendment for general damages based upon the alleged depletion of Kansas' share of the Arkansas River. However, Colorado did object to the claim for special damages resulting from depletion of groundwater in the Ogallala Aquifer, essentially a nonrenewable source, if this claim were based upon facts not originally alleged. In its reply, Kansas acknowledged that the claim for special damages did in fact stem from allegations already made. Again, the United States took no position on this second motion to amend. By order of October 12, 1989, I allowed both Kansas amendments. Colorado and the United States thereupon filed answers to the Kansas First Amended Complaint.

The case was tried on the basis of these amended pleadings, copies of which are included in the Appendix as Exhibit 2 (Kansas First Amended Complaint); Exhibit 3 (Colorado Answer to First Amended Complaint and Counterclaim); and Exhibit 4 (Answer of the United States to the First Amended Complaint).

B. Special Master.

On July 7, 1986, the Court appointed the Hon. Wade H. McCree, Jr. as the Special Master in this case. 478 U.S. 1018, 92 L.Ed.2d 736, 106 S.Ct. 3330 (1986). Judge McCree conducted an initial pretrial conference on August 20, 1986. At that time, the parties agreed that discovery would be conducted under Rules 26-37 of the Federal Rules of Civil Procedure, or by stipulation. The states also

agreed upon certain other arrangements for the production and copying of documents and records. A written stipulation including the various agreements was mailed to Judge McCree on December 17, 1986, but he died before giving his approval. Nonetheless, the parties have continued to honor the stipulation, and the case has generally been tried according to the Federal Rules of Civil Procedure. (See Supreme Court Rules for original jurisdiction, Rule 17.)

I was appointed to replace Judge McCree as Special Master on October 19, 1987.[13]

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[13] The Court's order referring this matter to me states:

"It is ordered that Arthur L. Littleworth, Esquire, of Riverside, California, be appointed Special Master in place of the Honorable Wade H. McCree, Jr., deceased.

"The Special Master shall have authority to fix the time and conditions for the filing of additional pleadings and to direct subsequent proceedings, and authority to summon witnesses, issue subpoenas, and take such evidence as may be introduced and such as he may deem it necessary to call for. The Special Master is directed to submit such reports as he may deem appropriate.

"The compensation of the Special Master, the allowances to him, the compensation paid to his legal, technical, stenographic and clerical assistants, the cost of printing his report, and all other proper expenses, including travel expenses, shall be charged against and be borne by the parties in such proportion as the Court may hereafter direct."

C. Initial Proceedings.

My first status conference was held on February 26, 1988 in a hotel near the Los Angeles airport. In addition to representatives of the two states, counsel for the United States also attended. The United States indicated that it was then in the process of deciding whether or not to intervene. Three federally owned dams and reservoirs have been constructed within the Arkansas River system in Colorado. These are John Martin Reservoir, Pueblo Reservoir and Trinidad Reservoir. Operations of the latter two are at issue in this case. Neither of the states objected to the participation of the United States as an intervenor.

(1) Place of Trial.

At this first meeting the place of trial was discussed. Counsel for both states indicated a preference for a neutral location outside of both states. The Los Angeles area appeared to be the best choice, and ultimately I arranged for courtroom space in the United States Court of Appeals, Ninth Judicial Circuit, Federal Building, 125 South Grand Avenue, Pasadena, California. The trial was held at that location.

(2) Exhaustion of Administrative Remedies.

At this initial status conference, Colorado indicated that it was again going to raise the issue of Kansas' exhaustion of administrative remedies as to two claims in the complaint. These related to the operation of Trinidad Reservoir on the Purgatoire River, and the postcompact

wells in Colorado. It was agreed that the exhaustion issue should be decided on motion, and on March 14, 1988, I issued an order requiring Colorado to file its motion within sixty days, and setting forth a briefing schedule for responsive and reply briefs. Oral argument was also held, in the Federal Court of Appeals in Pasadena on September 28, 1988. As part of its motion to stay, Colorado filed four large volumes of appendix documents, which dated back a number of years and which appeared to include all of the pertinent compact administration record with respect to postcompact well development and Trinidad Reservoir.

My decision on this motion was issued October 21, 1988. I denied the Colorado motion to return these issues to the compact administration, finding that such action would not be effective and that further delay would not be fair. The structure of the compact administration is such that even a preliminary investigation of the Kansas allegations had not proceeded. By exercising its veto on the commission, even though done in good faith, Colorado effectively prevented "authoritative Commission action." See *Texas v. New Mexico*, 462 U.S. 554, 568, 77 L.Ed. 2d 1, 103 S.Ct. 2558 (1983). A copy of my decision is included as Exhibit 5 in the Appendix.

(3) Site View.

It was also agreed at the first status conference that a site view of the Arkansas River Basin would be helpful. Accordingly, a tour was held on September 13 and 14, 1988, with representatives of both states and of the United States present. The itinerary covered both a land

and air inspection of the Arkansas River Basin from Pueblo, Colorado to Garden City, Kansas, including the Purgatoire River drainage area and Trinidad Reservoir.

(4) Partial Summary Judgment on 1951 Compact Administration Resolution.

Finally, at the Los Angeles status conference, it was agreed that the Kansas claim on the 1951 Compact Administration Resolution could be bifurcated and decided as a matter of law. In its complaint, Kansas alleged that any reregulation of the native waters of the Arkansas River requires the approval of the compact administration, based upon a resolution adopted by the administration on July 24, 1951. Specifically, this claim applies to the Winter Water Storage Program in Pueblo Reservoir. On November 28, 1988, Colorado filed a Motion for Partial Summary Judgment on this issue. Extensive briefs were filed by both states, together with several volumes of documentary evidence, some going back to events leading up to the adoption of the Arkansas River Compact in 1949.

My decision on the Colorado motion was issued September 15, 1989; I recommended that the motion for partial summary judgment be granted. This motion dealt with a discrete legal issue, namely, whether the compact administration had the authority to approve or disapprove the Winter Water Storage Program in Pueblo Reservoir. As part of these general proceedings, Colorado also moved that the question of any actual impact on Kansas of the Winter Water Storage Program be referred back to the compact administration. Again, the grounds were

based upon the alleged failure by Kansas to exhaust its administrative remedies. I denied that motion, and therefore the factual issue of whether the operation of the Winter Storage Program has materially depleted the waters of the Arkansas River in violation of the compact comprised one of the major issues at trial. A copy of my decision on these winter storage motions is included in this Report as Part II.

(5) Intervention by the United States.

The United States, on January 31, 1989, filed a Motion for Leave to Intervene as a Party Defendant. The motion was accompanied by a Stipulation for Intervention signed by counsel for both states. My order, dated February 9, 1989, granted the motion, allowing the intervention of the United States to represent the federal interests raised by the Kansas complaint and the answer and counterclaim filed by Colorado.

(6) Severance of Damage and Remedy Proceedings.

As part of the Kansas motion to amend its complaint to add claims for damages, Kansas also moved to sever all proceedings relating to damages, and to reserve those issues for subsequent proceedings following a final decision on liability. Initially, Colorado had strenuous objections to the motion, while the United States took no position. Following briefing and argument, however, Colorado focused its opposition on specific matters, and I attempted to recognize those concerns in my order. On

January 2, 1990 I granted the Kansas motion to bifurcate the trial into liability and remedy phases, provided that Colorado would not be limited during the liability phase from introducing such economic or other evidence related to damages as might be necessary to its defense on the issue of liability, or in support of its affirmative defenses or counterclaims. A copy of this order is included as Exhibit 6 in the Appendix.

(7) Allocation of Fees and Costs.

Pursuant to the agreement of the parties, and by order dated October 9, 1989, fees and costs in this case were allocated as follows: 40% to the State of Kansas, 40% to the State of Colorado, and 20% to the United States. The United States' share has been calculated from the time that it intervened, February 9, 1989.

D. Discovery, Expert Witnesses and Motions.

The parties began serious discovery in the fall of 1988. Discovery was extensive and became increasingly contentious. Numerous motions to compel production of documents and answers to interrogatories were filed. There were motions to quash subpoenas and motions to enforce compliance with subpoenas. Privileges were invoked and an *in camera* inspection was required. Protective orders and sanctions were sought. Motions *in limine* to exclude certain witnesses and areas of testimony were filed. No useful purpose would be served by reviewing these proceedings in detail. They occupy many volumes

in the records of this case, and can be specifically identified from the index. Perhaps it is sufficient here to report that I believe that all appropriate information was ultimately made available to the parties. Nor did any party acquire information that should have been protected. Finally, none of the discovery disputes seem to have carried over into the trial, or to have adversely impacted the full presentation of the parties' respective cases.

On September 22, 1989 I ordered that the parties designate their expert witnesses and the subject matter of their testimony by January 15, 1990. Kansas identified 24 experts, Colorado 41, and the United States 2. Not all of those originally identified actually testified, and under later procedures, some additional experts appeared who were not at first named. While some nonexperts also testified, the trial was dominated by expert witnesses.

Following a pretrial conference and argument on February 16, 1990, an additional order governing the discovery procedures for expert witnesses and certain other pretrial matters was issued. A copy of that order, dated March 7, 1990, together with the amendment thereto, is included as Exhibit 7 in the Appendix. The order required that all parties provide statements of the substance of the facts and opinions to which their expert witnesses were expected to testify, and a summary of the grounds for each opinion stated, as required by Rule 26(b)(4)(A)(i). A period of two months was allowed for the depositions of the Kansas experts, and an equal period for the depositions of the Colorado and United States experts. Copies of all exhibits were required to be exchanged by August 15, 1990. The authenticity of all documents designated as exhibits was deemed to be

admitted unless written objections were filed by August 29, 1990. All pretrial motions were required to be filed no later than August 15, 1990.

Certain substantive motions were disposed of before trial. For example, Colorado sought a ruling of law on the meaning of Article V-E(5) of the compact. This motion was denied, and the issue deferred to the trial. Kansas sought to have Colorado's affirmative defenses stricken. This motion, too, was denied.

The trial date was then set for September 17, 1990, and trial did commence on that date.

E. Pretrial Filings.

The pretrial order of March 7, 1990, required the parties to file statements of entitlement, in addition to pretrial statements. These statements taken together provide detailed views of the entitlements claimed by each state to receive or use the waters of the Arkansas River under the Arkansas River Compact. Moreover, they include considerable documentary evidence intended to support their positions.

Many of the hydrologic data and the facts concerning water use in Colorado and Kansas are in substantial dispute in this case. Similarly, the parties hold disparate views on the intent and meaning of the Arkansas River Compact. For these reasons, an agreed statement of facts was not possible. However, the parties did agree upon 169 joint exhibits which were lodged prior to trial. This number was supplemented by four additional joint exhibits filed shortly after trial began.

F. Trial.

The liability phase of the trial commenced on September 17, 1990. That portion of the trial was completed on December 16, 1992. During this period of time, there were 141 actual trial days. The reporter's transcript includes 19,735 pages through completion of the evidence, and the number of exhibits admitted and lodged exceeds 2,000.

The Kansas case was presented during the fall of 1990 and appeared to be largely completed by the end of January, 1991. At that time, the Kansas expert on the stand was Timothy J. Durbin. He was Kansas' chief technical expert and had begun his work on this case in 1985. After testifying for approximately one month, under direct and cross-examination, Mr. Durbin suffered a breakdown and was admitted to a psychiatric hospital. In the latter part of his cross-examination, it began to appear that a number of errors had been made in various Kansas exhibits, including at least one significant mistake in the coding instructions to the Kansas hydrologic-institutional model. Kansas began to file overnight revisions, sometimes more than once, to certain key conclusionary exhibits. This computer model was crucial to the Kansas case. It was used to estimate depletions in Stateline flows from 1950 to 1985 caused by postcompact wells and the Winter Water Storage Program in Colorado.

The trial was recessed while I attempted to find out more about Durbin's condition and when he would be able to return. A medical report was obtained from his attending physician, and Colorado requested that I obtain a second opinion which it paid for. I kept the details of

these medical reports confidential, although their general conclusions were made known to the parties. From my conversations with the two psychiatrists, and my review of their reports, I concluded that to protect Mr. Durbin's future well-being, and ultimately the proper presentation of the Kansas case, he should not be pressured into returning. It was clear that he would not have been able to resume his trial responsibilities soon, if at all.

Meanwhile, Kansas filed a formal motion to continue the trial for seven months in order to obtain and prepare replacement experts. Colorado objected to such a lengthy continuance for reasons which are discussed in detail in my March 27, 1991 order on the Kansas motion. A copy of that order is included as Exhibit 8 in the Appendix. The Kansas motion, of course, would also have delayed Colorado, which was then fully prepared and ready to proceed with its case. While I ruled that completion of the Kansas case on direct, and any rebuttal evidence, should be continued until either Mr. Durbin was able to resume or replacement experts were prepared, I did not believe that it was necessary or desirable to stop the trial entirely. Accordingly, Colorado was ordered to begin the presentation of its case, reserving Kansas' right to cross-examine on Colorado's modeling testimony when Kansas had expert assistance available. Under this modified trial procedure, Colorado completed its case in chief on May 30, 1991, subject to its right to respond to the completed Kansas case. RT Vol. 87 at 153, 156.

Because of other trial conflicts affecting various counsel and experts, the trial could not be resumed until February 24, 1992. At that time, Kansas began the presentation of what it called its "replacement case." Its new

chief expert was Steven P. Larson, who was assisted by several Kansas experts who had testified earlier but who now assumed expanded roles. Kansas referred to this group as its "replacement experts."

This team had made a number of corrections and modifications to the Kansas hydrologic-institutional model. Many of these changes had been recommended by the Colorado experts. Kansas lodged 63 modified exhibits, changing previously admitted evidence, and also lodged 10 new exhibits. As a result of this new work, the replacement experts testified that the Stateline depletion figures claimed earlier by Kansas were not reliable. They offered new opinions, substantially reducing the amount of the Kansas claim. For example, the exhibits presented through Mr. Durbin showed that postcompact wells in Colorado over the period of 1950-85 had caused depletions in the Arkansas River flows into Kansas totaling approximately 1,581,000 acre-feet. Kansas Exh. 111*. Larson reduced this amount to 852,000 acre-feet. Kansas Exh. 111***.[14] Kansas completed its replacement case and rested on March 18, 1992. RT Vol. 100 at 80-81.

Because of the modifications made to the normal order of trial, additional depositions were required from time to time, and many new exhibits not initially listed

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[14] These figures are in terms of depletions to total flows, not to usable flows. Ultimately, the compact requires that usable flows be addressed, but for illustrative purposes here the comparison between Durbin and Larson is more easily made using total flow figures. Also, these figures do not reflect any offset for return flows from transmountain imports. Kansas acknowledges that this adjustment is also necessary.

were required. However, all computer disks and backup data were required to be exchanged before court testimony. This was accomplished cooperatively, and generally without formal court orders.

Colorado then responded to the Kansas replacement case and completed its own case in chief. This segment of the trial began on April 27, 1992 and lasted through May 27, 1992. RT Vol. 117 at 160.

Presentation of the United States evidence followed immediately after Colorado. Since I had indicated that the Kansas claim arising from operations of Trinidad Reservoir (a federal facility) would be dismissed, the United States evidence centered upon the Winter Water Storage Program ("WWSP") in the Pueblo Reservoir. This program began in 1976 upon completion of Pueblo Reservoir and continued thereafter except for the year 1978. Under the program, Arkansas River flows were stored in the winter for later summer irrigation. Previously, the winter flows had been in part diverted to irrigate bare fields, and thereby increase soil moisture for the next growing season. The issue is whether or not storage and later summer use of this water depleted river flows at the Stateline. The United States completed its presentation on June 19, 1992. RT Vol. 124 at 102.

Kansas' rebuttal testimony and surrebuttal by Colorado and the United States commenced on September 21, 1992 and were completed on November 24, 1992. The evidentiary presentations of all parties were completed December 16, 1992. RT Vol. 141 at 107.

By agreement of the parties, opening briefs were submitted simultaneously on March 15, 1993, answering

briefs on May 3, 1993, and final reply briefs on May 17, 1993. Additional responses to specific written questions from me were filed August 24, 1993 and September 3, 1993.

My Draft Report was completed and circulated to the parties on February 4, 1994. Oral Argument on the draft was held on April 14 and 15, 1994.

G. Dismissal of Trinidad Reservoir Claim.

At the conclusion of Kansas' presentation of evidence on the operation of Trinidad Reservoir, counsel for Colorado announced that it would file a motion to dismiss that portion of the Kansas claim.[15] By stipulation, the Colorado motion was filed and briefed during the 1991 recess occasioned by Mr. Durbin's illness.

The motion was based upon the ground that Kansas had failed to demonstrate that the operation of the Trinidad Project resulted in a compact violation. Colorado argued that Article IV-D of the Arkansas River Compact specifically allows future development in Colorado, by federal or state agencies, including dams and reservoirs, provided that such development does not cause a material depletion in the usable flows of the Arkansas River to users in Kansas, and that Kansas had failed to establish the necessary depletion.

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[15] Although Kansas had not rested its entire case, its counsel indicated that Kansas had completed evidence on the Trinidad Project. RT Vol. 78 at 138, 144-45.

The Kansas legal theory was based upon the alleged violation of certain Operating Principles that were approved by the Arkansas River Compact Administration for the operation of the Trinidad Project. Kansas did not attempt to show a material depletion at the Stateline. Kansas took the position that any failure to abide by the Operating Principles constituted a compact violation; that during the initial period of operation of Trinidad Reservoir (from 1979 to 1984) the tributary inflows from the Purgatoire River into John Martin Reservoir on the Arkansas River were substantially less in certain months than they would have been if the Operating Principles had been strictly observed; and that Kansas was entitled to 40% of the water thus lost to the Arkansas River.

After extensive briefing and oral argument, and subject to confirmation by the Court, the Colorado motion was granted. A copy of my decision, dated June 9, 1992, is included in this Report as Part III.

H. Dismissal of Colorado Counterclaims.

During the 1991 summer recess, Kansas filed a motion to dismiss Colorado's two counterclaims. These were designated as the "Lake McKinney Counterclaim" and the "Well Counterclaim." The motion was filed under the guidance provided by Rule 41(b) of the Federal Rules of Civil Procedure.[16] While Colorado had not yet fully

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[16] Effective December 1, 1991, the vehicle for the result sought by the Kansas motion would be Rule 52(c) rather than Rule 41(b). However, the evidence was taken and briefing completed before the new rule took effect.

rested its case, its evidence on the Lake McKinney Counterclaim had been completed, and my ruling on the Well Counterclaim was not made until that evidence was also complete.

The Lake McKinney Counterclaim was based upon the allegation that Kansas had stored water released from John Martin Reservoir in Lake McKinney in Kansas, in violation of Article V-E(2) of the compact. I found that the Colorado evidence did not establish such a compact violation. Subject to confirmation by the Court, the Kansas motion to dismiss this counterclaim was granted. A copy of my decision, dated April 20, 1992, is included in this Report as Part IV.

Colorado's Well Counterclaim was based on the allegation that development of postcompact wells in Kansas had reduced the usable flow of the Arkansas River in Kansas by causing increased seepage or transit losses; that such losses had resulted in increased demands by Kansas against its storage account in John Martin Reservoir; and that the surplus in the Kansas Transit Loss Account was thereby reduced, 24/35ths of which would otherwise have been distributed to Colorado users. I found against Colorado on this counterclaim, and subject to confirmation by the Court, I granted the Kansas motion to dismiss. My decision, dated July 31, 1992, is included in this Report as Part V.

SECTION IV

DESCRIPTION OF THE ARKANSAS RIVER SYSTEM

The Arkansas River originates on the easterly slopes of the Rocky Mountains upstream of Leadville at elevations above 12,000 feet. The river flows south past the towns of Buena Vista and Salida, then easterly through the Royal Gorge to Canon City, and then into Pueblo Reservoir just upstream from the City of Pueblo. The elevation at Pueblo is 4,662 feet. From Pueblo the river meanders easterly across the Colorado high plains into Kansas. The elevation at the Stateline is 3,350 feet. Long-time USGS measurements at Canon City have been used consistently to represent the mainstream flows from the mountains. The portion of the river system that is involved in this litigation extends from Pueblo, Colorado to Garden City, Kansas. A general location map of the Arkansas River Basin in Colorado and Western Kansas is included in the back cover pocket of Volume I of this Report.[17]

The river valley between Pueblo and the Stateline, a distance of about 150 miles, is a fertile agricultural area with only a few small rural towns. Going downstream from Pueblo, the towns are La Junta, Las Animas, Lamar, Granada and Holly. In Kansas, the character of the land along the river continues to be agricultural. Between the Stateline and Garden City, the distance is approximately 62 miles. Substantially all of the normal surface flows of the Arkansas River are diverted and used by the time the

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[17] Submitted by the parties by letter dated February 21, 1994 for inclusion here.

river reaches Garden City. The river must rely upon more generous downstream tributaries and precipitation for its renewal.

In Colorado, the main tributary is the Purgatoire River, which joins the Arkansas from the south at Las Animas just upstream from John Martin Reservoir. The Purgatoire originates high in the Sangre de Cristo mountains about 40 miles upstream of Trinidad. Like the mainstream, it is fed by runoff from melting snow, and above Trinidad the flows are perennial. The other major contributors to the Arkansas from the south are the St. Charles, Huerfano, and Apishapa Rivers. The flows from these streams are intermittent and come primarily from intense summer rainstorms, although the drainage area of each of these streams includes some mountainous regions.

The major Colorado tributaries from the north are Fountain, Adobe, Horse and Big Sandy Creeks. These streams also are normally intermittent and dependent upon summer rains. With the exception of Fountain Creek, these streams drain the high plains territory and are not as productive as the southern tributaries.

The bed of the mainstream below Pueblo lies in a broad, sandy and frequently shifting channel. In Colorado, the river channel consists of the "valley fill aquifer." This aquifer fills a U-shaped trough cut into bedrock, which includes shale, limestone and sandstone. The valley fill aquifer, often referred to simply as alluvium or alluvial materials or aquifer, is highly permeable.[18] It ranges in width from about one to fourteen miles, with an

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[18] These terms were used interchangeably by witnesses at trial.

overall average width of approximately three miles. Thickness of the aquifer reaches more than 200 feet, but with an average depth of about 30 feet. The groundwater in the valley fill aquifer is in hydraulic continuity with the surface flows of the river. They constitute a common water supply. Jt. Exh. 66 at 2; Jt. Exh. 94 at 51. Thus, groundwater supports and contributes to the surface flows of the river, but pumping by wells can draw water away from the river. Jt. Exh. 157 at 11; Jt. Exh. 91 at 3; Jt. Exh. 94 at 1, 51, 53; RT Vol. 30 at 59.

Surface flows of the Arkansas River in Colorado are diverted by 23 major canal companies, which then distribute water to individual farmers. In addition, since 1949 when the compact was approved, farmers in Colorado according to Colorado data have constructed more than 1,300 large irrigation wells located in the valley fill aquifer. Colo. Exh. 165*, Table A.1. The number is even larger according to Kansas. These wells are largely pumped to supplement surface supplies. Surface and groundwater together provide irrigation supplies for more than 300,000 acres between Pueblo and the Stateline. Colo. Exh. 823, 827-30.

In certain reaches of the river in Colorado, the river alluvium is flanked by bench areas of older, less permeable deposits. Colorado describes these as "surficial aquifers," while Kansas simply calls them "bench aquifers." In any event, these areas are part of the tributary groundwater supply. Wells located in these areas are not as productive as those drawing from the valley fill aquifer.

In Kansas, the Arkansas River roughly parallels U.S. Highway 50, and passes through the towns of Coolidge,

Syracuse, Kendall, Lakin, Deerfield, Holcomb and Garden City. Kan. Exh. 471; RT Vol. 27 at 50. The distance from the Stateline to Garden City is approximately 62 miles. *Id.* at 52. Originally eight canal companies in Kansas diverted surface flows of the Arkansas River in this reach. Today the Alamo and Fort Aubrey ditches no longer operate, although the lands formerly irrigated by these ditches continue to be irrigated by wells. RT Vol. 28 at 15. The ditch companies remaining in operation between the Stateline and Garden City are: the Frontier, Amazon,[19] Great Eastern, South Side, Farmers and Garden City. Kan. Exh. 389**; RT Vol. 27 at 51-52. In 1988, approximately 57,000 acres were irrigated by surface diversions and alluvial wells. Kan. Exh. 358*; RT Vol. 31 at 57. The primary crops raised are corn, wheat, grain sorghums, alfalfa and soybeans. RT Vol. 27 at 60.

The river alluvium in Kansas between the Stateline and Garden City extends on both sides of the river, generally 1 to 1.5 miles, although a greater distance in some parts. RT Vol. 28 at 65. The thickness of alluvium ranges between 35 and 50 feet. *Id.* at 64. Between the Stateline and the Bear Creek fault zone, the Arkansas River and its associated alluvium occupy a trough eroded through bedrock. RT Vol. 29 at 134. The Bear Creek fault zone, however, cuts across the river just west of Lakin in mid-Kearny County and divides the Arkansas River Valley in Kansas into two distinct parts.[20]

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[19] This is the common name. Technically it is the Kearny County Farmers Irrigation Association Ditch. RT Vol. 27 at 96.

[20] The Bear Creek fault zone is about 48 miles from the Stateline. Jt. Exh. 139.

Upstream, as I have indicated, the river alluvium is underlain by bedrock which is essentially non-waterbearing. Downstream of the fault zone, however, the river alluvium overlies another lower aquifer, generally referred to as the Ogallala. The Ogallala formation is about 275 feet deep in Kearny County and 350 feet deep in Finney County. RT Vol. 28 at 76-77. Since the early 1960s most new or replacement wells have been drilled down to the bottom of the Ogallala. *Id.* at 68. The service areas of the canal companies virtually all overlie alluvium, except for the Great Eastern and Farmers. Kan. Exh. 407-12. Some portions of the ditch service areas also overlie the Ogallala. RT Vol. 28 at 18.

Surface flows of the Arkansas River are also augmented by diversions from the westerly slopes of the Rocky Mountains. Water users in the Arkansas River Basin in Colorado began such importations at the turn of the century, using tunnels and ditches to bring the water across the Continental Divide. RT Vol. 14 at 131 *et seq.* Jt. Exh. 5, Table 10. The Fryingpan-Arkansas project, authorized by Congress in 1962, substantially augmented those private facilities and increased the amounts of water imported. The Fryingpan-Arkansas project includes Ruedi Reservoir on the western side of the Continental Divide, four dams and reservoirs on the eastern slopes of the Rockies (Turquoise Lake, Mt. Elbert, Twin Lakes and Clear Creek Reservoirs) and Pueblo Reservoir on the Arkansas River just west of Pueblo, Colorado. Jt. Exh. 88 at 4.22-4.23. Over the 1950-85 period, transmountain imports have added an average of approximately 60,000 acre-feet per year to the Arkansas River. The Arkansas River Compact excludes such transmountain diversions,

and Kansas makes no claim to them, or to the return flows therefrom. Article III-B; RT Vol. 11 at 127.

SECTION V

DESCRIPTION OF MAJOR STORAGE AND DIVERSION WORKS

A. Surface Diversion Systems.

Surface flows of the Arkansas River in both Colorado and Kansas are diverted and distributed for irrigation through a number of canal companies. Often they are referred to as "ditches," but this friendly colloquialism greatly underplays the size of their facilities and operations. Colorado calculated that surface diversions by the various canal companies between Pueblo and the Stateline averaged 884,881 acre-feet annually for the 1950-85 period. Colo. Exhs. 838, 839. These systems include major diversion structures, as well as distribution and off-stream storage facilities. In Colorado there are 23 canal systems with rights to take water from the Arkansas River between Pueblo and the Stateline. Nine of these canals are located below John Martin Reservoir.

In Kansas, beginning about 1880, eight canals were developed with rights to divert Arkansas River water in the reach from just above the Stateline to Garden City. All of the data on Stateline flows have been adjusted to include Kansas diversions on the Colorado side of the line. Only six of those canals continue to be in operation. Diversions for 1950-88 averaged 78,742 acre-feet annually. Kan. Exh. 371*.

B. Wells.

In addition to the surface diversion systems, a large number of wells have been drilled in both states, most of them after the compact was approved in 1949. In 1985, the evidence showed a total of 2,062 permitted and decreed irrigation wells in Colorado, associated with 171,614 acres. Colo. Exh. 165*, Tables A.1-A.3. These were large wells of 100 gpm or more pumping from the Arkansas River and its associated alluvium, and from the surficial aquifer. In Kansas, a 1988 study found that a total of 16,679 acres between the Stateline and Garden City were being irrigated by wells pumping alluvial groundwater. Kan. Exh. 358* at 1.

C. Canal Company Storage Reservoirs.

Four of the canal systems in Colorado (Holbrook, Fort Lyon, Amity and the Colorado Canal) have off-channel reservoirs providing storage. These include Lake Henry and Lake Meredith; the Holbrook, Dye, Adobe Creek and Horse Creek Reservoirs; and the Great Plains Reservoir System. Colo. Exh. 824. The total storage capacity of these various private systems is in the order of 800,000 acre-feet. Colo. Exh. 3 at 3-12. However, they are relatively shallow and evaporation is extremely high. All of these Colorado canal company reservoirs operate under the Colorado appropriation system with various priority dates. All were in place prior to the Arkansas River Compact.

In Kansas, there is only one small reservoir, Lake McKinney. It is located near Garden City and has a current capacity of approximately 3,600 acre-feet, although it was somewhat larger in earlier years.

D. Trinidad Reservoir.

Major storage on the Arkansas River system is also provided by three federal reservoirs, namely, Trinidad Reservoir on the Purgatoire River, and Pueblo Reservoir and John Martin Reservoir on the mainstream. The Trinidad Project resulted from cooperative studies by the Corps of Engineers and the Bureau of Reclamation in the early 1950s. At first, Kansas opposed the project, stating that "even the most conservative estimates indicate an increased depletion of Purgatoire River water." Jt. Exh. 34 at XV. However, after certain operating principles were approved, Kansas withdrew its opposition. The project was approved by Congress in 1958, and was completed and ready to store water in 1977. Jt. Exh. 35 at 309; Jt. Exh. 23 at 4. The total capacity of the reservoir is in the order of 114,000 acre-feet, providing both flood control and water conservation storage. Jt. Exh. 24a. As already noted, during the trial Kansas pursued a claim for injury based upon an alleged violation of the operating principles adopted for the reservoir. Subject to confirmation by the Court, I have dismissed that claim in a separate decision included as Part III of this Report.

E. Pueblo Reservoir.

Pueblo Reservoir, located on the mainstream of the Arkansas River just above the City of Pueblo, is the

terminal reservoir of the Fryingpan-Ārkansas project. That project was authorized by Congress in 1962, and construction of Pueblo Reservoir was substantially completed in 1975. Colo. Exh. 3, Table 2.1. The Fryingpan-Arkansas project is administered by the Southeastern Colorado Water Conservancy District, organized under the laws of Colorado. It is the legal agency responsible for repayment of the reimbursable costs of the project. The 1977 capacity of Pueblo Reservoir was estimated at 357,678 acre-feet. Besides providing flood control, Pueblo Reservoir is used primarily for the regulation of transmountain water imported from the westerly side of the Rocky Mountains under the Fryingpan-Arkansas project. However, the reservoir is also used to store native wintertime flows that are used later for summer irrigation under the Winter Water Storage Program. Colo. Exh. 532. Whether the operation of the Winter Water Storage Program has caused a material depletion in Stateline flows was one of the principal trial issues. The program was begun in 1976 and has been in operation since that time, except for the year 1978.

Pueblo Reservoir also has an independent right to store and retain native flows, with an appropriation date of 1939. However, this right comes into priority only when John Martin is full and all other diversion rights between Pueblo and John Martin have been satisfied. In essence, the right applies only during periods of major flooding. Jt. Exh. 129 at 46.

F. John Martin Reservoir.

John Martin is the largest of the federal reservoirs, located on the mainstream of the Arkansas River about 58 miles above the Stateline. The reservoir was authorized by Congress in 1936, and construction began in 1939. 49 Stat. 1570 (1936), codified at 33 USC §§ 701 *et seq.* After an interruption in construction caused by World War II, the dam and reservoir were completed in 1948. RT Vol. 15 at 35-36. Total storage capacity was approximately 700,000 acre-feet upon completion. 420,000 acre-feet of this capacity was allocated for conservation storage, and 280,000 acre-feet for flood control. Jt. Exh. 16 at 37. Because of sedimentation, however, the conservation storage capacity as of 1988 has been reduced to approximately 338,000 acre-feet. RT Vol. 16 at 126.

Developing criteria for the operation of this reservoir was one of the principal purposes of the Arkansas River Compact. Article V specifically provides how water will be stored and released from the reservoir. The compact creates a "conservation pool" to be operated "for the benefit of water users in Colorado and Kansas, both upstream and downstream from John Martin Dam . . . ." Article IV-C(3). During the winter months, all water entering the reservoir is stored in the conservation pool, except that Colorado has the right to releases equivalent to the river flow up to 100 cubic feet per second ("cfs"). Article V-A.

During the summer, defined as April 1 to October 31, no flows may be stored in John Martin Reservoir when Colorado water users are operating under judicially decreed priorities. Article V-B. Under these conditions,

Kansas is not entitled to any portion of the river flow entering John Martin Reservoir, but is apportioned whatever river flow may cross the Stateline. Article V-G. Downstream from John Martin, the return flows from Colorado users in the area, as well as occasional tributary inflow, contribute to the flow of the river reaching the Stateline.

When Colorado water users are not operating under decreed priorities, all summer flows entering the reservoir are stored, provided that Colorado may demand releases of water equivalent to the river flow up to 500 cfs, and Kansas may demand releases of water equivalent to that portion of the river flow between 500 cfs and 750 cfs. Article V-B.

Under the compact, neither state is allocated a specific share of the water stored in the conservation pool. Rather, such stored water constitutes a common resource to be released ". . . upon demands by Colorado and Kansas concurrently or separately at any time during the summer storage period." Article V-C. Specific release rates are provided for each state, depending upon the amount of water in storage. The only limit, however, upon the total amount of water that either state may take is the requirement that such water must be applied promptly to beneficial use, unless storage thereof downstream is authorized by the compact administration. Article V-E(2). Thus, water demanded by the first state to call automatically reduces the supply available to the other state. As a result, both states in recent times have generally demanded simultaneous releases at maximum rates in order to ensure that they would receive their share of stored water, even though all parties might not be ready

for delivery. Jt. Exh. 129 at 47; RT Vol. 66 at 54; RT Vol. 81 at 127-29; RT Vol. 133 at 76.

In practice, operation under the compact resulted in the storage of most, if not all, of the inflow from November 1 to March 31. In many years at the end of the winter storage season, the reservoir storage was completely drawn down early in the irrigation season, sometimes by mid-April. Jt. Exh. 129 at 47.

In 1980 the Arkansas River Compact Administration adopted a resolution concerning the method of operating John Martin Reservoir. It is entitled "Resolution Concerning an Operating Plan for John Martin Reservoir" and is included as Exhibit 10 in the Appendix, as revised in 1984. Jt. Exh. 21, Doc. 11. The resolution abandons the common pool concept in favor of allocating specific state shares in the stored water. Under the 1980 Operating Plan, 40% of the stored water goes into a separate "Kansas account," while 60% is divided in varying shares among the nine Colorado canal companies located within Colorado Water District 67. *Id.*, Section II-D(2)(3). Kansas and the various Colorado ditches may demand release of the water contained in their respective accounts at any time and at whatever rates they desire. *Id.*, Section II-E(1).

The 1980 Operating Plan also allows three Colorado canal companies, namely, Amity Mutual Irrigation Company, Fort Lyon Canal, and Las Animas Consolidated Canal Company, to store certain "other water" in John Martin Reservoir. *Id.*, Section III-A,B,C. The permitted storage consists of water which Amity could otherwise divert from the Arkansas River and store in the Great Plains Reservoir System, and water which the other two

canal companies could store under an approved Pueblo Winter Storage Plan. *Id.*, Section III-A,B,C.

In exchange for this storage right, the three Colorado canal companies agreed to a 35% water surcharge on all their deliveries into John Martin Reservoir. *Id.*, Section III-D. This 35% goes into a Kansas Transit Loss Account. Releases of stored water from the Kansas account are measured at the Stateline, and transit losses between John Martin and the Stateline are made up from this Kansas Transit Loss Account. *Id.*, Section II-E(4).[21]

G. Transmountain Diversions.

Flows in the Arkansas River have long been supplemented by transmountain diversions imported from the western slopes of the Rocky Mountains. The earliest of these diversions began in the 1880s. Colo. Exh. 3, Table

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[21] The 1980 Operating Plan, as revised on May 10, 1984 and December 11, 1984, is currently in effect. However, the resolution continues on a year-to-year basis, and may be terminated by either state. Section VII-A. Witnesses from both states supported its continued operation. Nonetheless, in its Pre-trial Statement, at pages 165-166, Kansas took the position that:

> ". . . while Kansas believes that the 1980 Resolution results in a more efficient operation of John Martin Reservoir . . . the resolution is an administrative rewriting of Article V of the Arkansas River Compact and thus is *ultra vires* and legally void *ab initio*."

During the trial itself Kansas did not appear to pursue this position. However, in its post-trial briefs Kansas still takes the position that 1980 Operating Plan, although beneficial, is beyond the powers of the compact administration and hence is "illegal." Kan. Reply Br. at 17, 22. This matter is discussed further in Section XIV of this Report.

3.11; Jt. Exh. 5, Table 10. Between 1890 and 1910 a number of tunnels and ditches and three reservoirs in the headwaters area were constructed. During the period 1908-42, imports averaged only 11,987 acre-feet annually. But about 1935 transmountain diversions began to increase significantly, and during the compact negotiations they were averaging approximately 43,000 acre-feet per year. Jt. Exh. 16 at 37; Jt. Exh. 5, Table 10. Not all of the transmountain imports, however, are used along the Arkansas River. These diversions also supply the cities of Aurora and Colorado Springs.

The Fryingpan-Arkansas Project was approved by Congress in 1962. Construction began in 1963 and was virtually complete by 1980, but diversions through the Charles Boustead Tunnel, a part of the project, began in 1972. Since 1972, total transmountain imports through the Fryingpan-Arkansas Project and the various other systems have averaged about 120,000 acre-feet per year. RT Vol. 21 at 25. Estimates of the average amounts delivered for use within the Arkansas River Valley during the 1950-85 period range between 56,210 and 60,445 acre-feet annually. Colo. Exh. 846.

SECTION VI

ARKANSAS RIVER SUPPLY

Most of the hydrologic data analyzed and presented by both states covered the period from 1950 through 1985. The first year after the approval of the compact was 1950, and this action was commenced at the end of 1985. This period of time was also used by Kansas in its hydrologic-institutional model and by Colorado in its water budget analysis. However, certain older reports that included river flow data from earlier years were also submitted into evidence, particularly with respect to the mainstream inflow at Canon City before Pueblo Reservoir was constructed, and the river flows at the Stateline.

Both states used measurements just downstream from Pueblo Reservoir to represent the supply of the mainstream. These data included some transmountain imports, and in more recent years also reflected the impact of storing winter flows in Pueblo Reservoir for later release. However, the total amount of water available for downstream use includes more than just the mainstream inflow at Pueblo. Tributary inflow, releases from other downstream reservoirs, groundwater, precipitation, and return flows from stream diversions and groundwater pumping all add to the total Arkansas River water supply available in Colorado.

A. Mountain Inflow.

While the amounts of tributary inflow and groundwater pumping were sharply contested during the trial, the two states essentially agreed upon the mainstream supply at Pueblo. Kansas computed the average annual

flow to be 585,157 acre-feet for the 1950-85 period, while Colorado put the average at 582,805. Colo. Exh. 831.[22] These data include transmountain imports and the inflow from Fountain Creek. The difference over this period of time is not material for the issues in this case. Most of this water comes from melting snow, and the flows are largest during the spring and early summer. Winter flows are relatively low. Precipitation downstream of Pueblo averages only 12 inches a year, although it increases toward the east and into Kansas. Jt. Exh. 105 at 7. Eighty percent of the precipitation occurs during the growing season of April through October, but without irrigation, rainfall is not sufficient to mature crops. Jt. Exh. 105 at 7.

The estimates by the two states of deliveries of transmountain water during the 1950-85 period were also close. These delivery figures are somewhat less than the total amounts of water imported from the western slope of the Rockies since some of that water is used outside of the Arkansas River area, some is lost to reservoir evaporation, and in a given year water is sometimes held over

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[22] These figures can be compared with longer-term averages at Canon City, where the river emerges from the mountains. An engineering committee report prepared for the compact negotiations shows an average annual flow at Canon City of 514,300 acre-feet for the period 1908-42. Jt. Exh. 5, Table A at 13 and 9. A 1968 Colorado report computes the Canon City annual average at 518,000 acre-feet for the years 1924-66. Jt. Exh. 92 at i. Another Colorado report done in 1975 estimates the 1935-50 average annual flow at 509,400 acre-feet, and the 1951-72 average at 513,600 acre-feet. Jt. Exh. 94 at 49. Transmountain imports increased in the later postcompact years.

in storage. Kansas estimated 60,445 acre-feet as the average annual amount of transmountain water delivered to the Colorado canal companies for irrigation use during the 1950-85 period. The best comparable Colorado estimate was 56,210 acre-feet. Colo. Exh. 846. Kansas makes no claim to this transmountain water. RT Vol. 11 at 127. It is specifically excluded from the Arkansas River Compact. Article III-B. Nonetheless, return flows from such imports still affect downstream flows and use.

Considering only native Arkansas River flows, that is, excluding transmountain imports, the mainstream supply does not show a significant historic decline. Declining flows at the Stateline cannot be explained by a comparable decrease in the mainstream inflow from the mountains. Colorado maintains, however, that the inflows from the tributaries have declined.

B. Stateline Flows.

The flow of the Arkansas River at the Colorado-Kansas Stateline is well gaged, and the states do not dispute these measured amounts. Colo. Exh. 4*, Table 5.8; Colo. Exh. 920. However, the gage measurements reflect total flows, including flood flows. Occasionally there are brief but high-intensity thunderstorms that produce large volumes of water which are not usable, but which nonetheless can significantly influence any simple arithmetical average. Moreover, the controlling provision in the Arkansas River Compact requires that upstream development shall not materially deplete the "usable quantity or availability" of water for use in Colorado or Kansas. Article IV-D. Thus Kansas' rights must ultimately be

judged in terms of usable flows, which were a major issue during the trial. However, for the purpose here of a general view of river supplies, unadjusted gage figures are used.

For the 1950-85 period, Stateline flows averaged 144,051 acre-feet per year. Colo. Exh. 4*, Table 5.8; Colo. Exh. 730. Colorado acknowledges that the Stateline flows have declined.[23] During the dry decade of the 1970s, flows averaged only 72,203 acre-feet annually. Colo. Exh. 4*, Table 5.8. The average for the last 20 year period which included wet years is still only 117,823 acre-feet. *Id.*, calculated for years 1966-85.

Earlier reports show considerably higher flows. For example, the Interim Report of the engineering committee prepared during the compact negotiations showed that Stateline flows averaged 280,800 acre-feet annually over the 1908-42 period. Jt. Exh. 5, Table D at 16. Even during an earlier dry decade, 1931-40, they averaged 146,200 acre-feet. *Id.* In a 1944 settlement plan proposed by C. L. Patterson, the Chief Engineer of the Colorado Water Conservation Board, average Stateline flows for 1908-38 were given as 260,700 acre-feet per year. Jt. Exh. 8 at 22. Colorado also submitted these same flow numbers

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[23] See the testimony of one of Colorado's chief experts at RT Vol. 114 at 115-16; also RT Vol. 115 at 73-76. Mr. Helton testified that the decline since 1950 was due to a combination of causes: a decrease in tributary inflow, an increase in consumptive use by phreatophytes, and "partly because of post-Compact well pumpage." RT Vol. 114 at 116. He agreed there was a "trend of increase in depletions to state line flows." RT Vol. 133 at 57-58.

to the Special Master in 1941 during earlier Supreme Court litigation. Kan. Exh. 379 at 2.

Similar figures were used in a 1961 Bureau of Reclamation Report for 1921-56 showing an average of 262,000 acre-feet annually. Colo. Exh. 113 at 6. According to a 1968 report prepared for the Colorado State Legislature, Stateline flows for 1924-42 averaged 194,000 acre-feet.[24] Jt. Exh. 91 at 10. A 1974 USGS report shows an annual average of 210,000 acre-feet for the years 1941-65. Jt. Exh. 78. In 1975 the Colorado Division of Water Resources issued a report which compared average Stateline flows for the periods 1935-50 and 1951-72, showing a decline from 280,900 acre-feet annually to 171,300. Jt. Exh. 94 at 49. Over the same periods, inflow at Canon City increased slightly. *Id.* After construction of John Martin Reservoir some decline in Stateline flows was to be expected. Kansas understood during the compact negotiations that it would get less total flow, but that its supplies would be better regulated and more usable. Kan. Exh. 129, Vol. II at 383.

C. Tributary Inflows.

One of the issues in the case is the extent to which tributary inflows to the mainstream have declined and thus may partially account for Stateline depletions. The issue is not easily resolved since the only tributaries that have been consistently gaged are Fountain Creek, and the

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[24] This average excluded the extraordinarily high flows of 1942, which were estimated at more than 1.3 million acre-feet.

Apishapa and Purgatoire Rivers. These latter two tributaries drain about 4,429 square miles, but approximately 15,272 square miles lie within the drainage areas of the other tributaries. Colo. Exh. 4*, Table 1.2. During the trial Kansas attempted to estimate the ungaged tributary inflow by developing a rainfall-runoff model based on certain correlations, the output of which was fed into its integrated hydrological-institutional model. Colorado was critical of both the Kansas methodology and results, but used its own water budget analysis to develop ungaged tributary flows as the residual of the budget process. It is perhaps sufficient to note at this point in the Report that the states are in lively disagreement over the ungaged flow from the various tributaries.

D. Overappropriated Surface Supplies.

The surface flows of the Arkansas River in Colorado are greatly overappropriated, and decreed surface rights suffer frequent shortages. *Fellhauer v. People*, 167 Colo. 320, 447 P.2d 986 (1968); Jt. Exh. 157 at 9. Lands under a majority of the canals experience moderate to severe shortages of surface water after June, when the snowmelt is generally gone. Jt. Exh. 92 at i. In fact, the river was fully appropriated before the turn of the century, and in most years there is not enough water to provide a full irrigation season supply for any priority dates after 1880. RT Vol. 76 at 42-43, 108-09; Kan. Exh. 16; Jt. Exh. 105 at 34.

A Colorado expert witness also testified that the effective surface water supply in Colorado averaged 720,533 acre-feet annually during 1950-85. Colo. Exh. 727*; RT Vol. 116 at 33-35. These surface supply figures include tributary inflow as well as mainstream flows

from the Rocky Mountains, but do not include groundwater. The headgate diversion requirements of the Colorado canals for the same period were estimated at 1.18 million acre-feet per year. *Id.* Diversion requirements were based on a "full water supply," that is, the amount of water needed for "optimum crop production." RT Vol. 82 at 162. Colorado witnesses consistently characterized the system as being "water short." RT Vol. 82 at 46, 163; RT Vol. 116 at 34; RT Vol. 65 at 127, 147, 152; RT Vol. 71 at 81; RT Vol. 72 at 99-100; RT Vol. 76 at 42; RT Vol. 77 at 19.

When permitted by their priority rights, canal companies in Colorado frequently divert the full flow of the river. Canals with senior rights like Fort Lyon often "sweep the river," that is, take all the surface flow available at their headgates. RT Vol. 82 at 43; RT Vol. 66 at 129; RT Vol. 78 at 124. Surface flow must then be restored from return flows, precipitation, downstream tributary inflow, and releases from downstream storage. That becomes the supply for downstream users with later priorities. Diversion and rediversion of normal streamflows sometimes leaves long reaches of the river dry, or nearly so. Jt. Exh. 96, Vol. I at 25. One Colorado expert testified that basically all of the snowmelt is diverted or used in Colorado, either for irrigation or by phreatophytes and reservoir evaporation. RT Vol. 66 at 36-38, 41.

Following World War II, the development of new well technology (the high capacity turbine pump), together with the availability of cheap power, led to a great increase in the number of wells along the Arkansas River. Prior to 1957 a well could be drilled in Colorado without any kind of water right permit, and even after that time, the issuance of a permit was ministerial. Before

1965, a new well could not be denied on the basis of injury to prior vested rights. RT Vol. 76 at 25, 41, 100. Well pumping thus became the way to supplement inadequate surface supplies. And pumping from such postcompact wells became one of the principal issues in this case.

SECTION VII

MAJOR ISSUES AND CLAIMS OF THE PARTIES

There are two ultimate issues left to be decided in this Part I of the Report: (1) whether the increase in groundwater pumping in Colorado since the adoption of the Arkansas River Compact has violated the compact, and if so, to what extent; and (2) whether Colorado[25] has violated the compact through the implementation of the Winter Water Storage Program, and if so, to what extent. Kansas' claim arising from the operation of Trinidad Reservoir was dismissed earlier, subject to confirmation of the Court. A copy of that decision dated June 9, 1992 is included in this Report as Part III.

Colorado's two counterclaims, designated as the Lake McKinney Counterclaim and the Well Counterclaim, were also dismissed previously, subject to confirmation of the Court, by decisions dated April 20, 1992 and July 31, 1992. These decisions are included as Parts IV and V, respectively, of this Report.

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[25] The allegations in the amended complaint run against Colorado, although the WWSP is operated in Pueblo and John Martin Reservoirs, federal facilities, with the consent of the United States. The amended complaint actually refers to Colorado's rejection of the Arkansas River Compact Administration resolution of July 24, 1951, allegedly requiring that any reregulation of the native water of the Arkansas River be approved by the compact administration. I granted Colorado's motion for partial summary judgment on this legal issue, by order dated September 15, 1989 (Part II of this Report), but reserved for trial the factual issues "concerning any impact of the winter storage program on Kansas' entitlement under the Compact."

In its First Amended Complaint, Kansas also alleges that Colorado has failed and continues to fail to make deliveries of releases to which Kansas is entitled from John Martin Reservoir by an equivalent in Stateline flow, as required by Article V-E(3) of the compact, and in violation of Articles V-E(4) and V-H(2). However, these provisions were not separately addressed during the trial, apart from the overall claim of material depletions of Stateline flows caused by postcompact pumping and the WWSP.

More specifically, the major issues remaining and the claims of the parties are:

(1) *Burden of Proof.* Kansas states that this is a compact enforcement case, not an equitable apportionment proceeding, and that the ordinary preponderance of the evidence standard applies. Colorado and the United States, on the other hand, contend that the appropriate test is "clear and convincing proof."

(2) *Meaning of the Compact.* Kansas asserts that the compact achieves the equitable apportionment of the Arkansas River that was not made by the Supreme Court in the two prior interstate cases.[26] In the Kansas view, the essential apportionment provisions are: Article IV-D which preserves the usable flows that were available to Kansas at the time of the compact, as well as those which have or may become available as a result of the compact; and Article V which apportions the normal summer

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[26] *Kansas v. Colorado*, 206 U.S. 46, 51 L.Ed. 956, 27 S.Ct. 655 (1907); *Colorado v. Kansas*, 320 U.S. 383, 88 L.Ed. 116, 64 S.Ct. 176 (1943).

flows, and the new usable flows resulting from the construction and operation of John Martin Reservoir. It is the Kansas position that Article IV-D includes not only wells constructed after the compact, but also increased pumping from precompact wells. Colorado contends that the compact provides for a flexible and indeterminate apportionment based upon the right of both states to make demands for releases from John Martin Reservoir. With respect to wells with precompact dates of appropriation, Colorado asserts that Article VI-A(2) allows the amount of pumping to increase beyond precompact levels.

(3) *Equitable Defenses.* Colorado asserts that Kansas is subject to laches and related equitable defenses, and should be barred from complaining about the effects of well development which occurred in Colorado prior to 1965. In the alternative, Colorado asserts that this delay in complaining should "gravely add to the burden" that Kansas otherwise would bear, and must be weighed in considering the equities of the case. It is the Kansas position that laches does not apply as a matter of law in a case of this kind, and that it has not been established by the facts in any event. During argument on my Draft Report, Colorado contended that equity should at least preclude damages for any wrongful pumping prior to approximately 1975, although such argument did not include a bar to prospective relief.

(4) *1980 Operating Plan.* Colorado contends that the benefits accruing to Kansas under the 1980 Operating Plan approved by the Arkansas River Compact Administration should offset and bar any claim by Kansas for breach of the compact after 1980; moreover, that such benefits more than offset the impact of wells constructed

east of the Buffalo Canal headgate after 1965. During oral argument on my Draft Report, however, Colorado asserted that at the very least the 1980 Operating Plan should mitigate any damages for the period after 1980. Kansas argues that Article VI of the 1980 plan precludes these Colorado contentions; that Kansas' benefits under the 1980 plan were separately bargained for and may not be used to offset Stateline depletions; that Colorado also received substantial benefits under the plan; and that the plan goes beyond the legal authority of the compact administration and may not be relied upon by Colorado to defeat the Kansas claims. Moreover, Kansas argues that Colorado's position with respect to the 1980 Operating Plan would amount to an unlawful modification of the compact by the Arkansas River Compact Administration. Colorado responds that it does not claim that the compact can be altered without congressional approval, but rather that the voluntary conduct of Kansas may be considered in determining whether Kansas is entitled to enforce an equitable right or remedy.

(5) *Precompact Pumping*. Both states acknowledge that a certain amount of precompact pumping was "grandfathered" under the compact, and should not be considered in connection with the Kansas claim based on depletions caused by wells. Kansas conceded pumping of 11,000 acre-feet annually, that is, the amount of pumping which it estimated occurred in 1948. Colorado contends the Kansas figure is legally wrong, as well as being factually incorrect. Colorado instead adopted an approach based on claimed entitlements under Colorado law and Article VI-A(2) of the compact. The amounts of this claimed exempt pumping varied year by year, but

according to Colorado averaged 49,275 acre-feet over the 1950-85 period. If a single figure is to be used to represent precompact pumping, Colorado contends that early estimates used by the USGS and others are low, and that the amount should be on the order of 36,000 acre-feet annually. Both states agree that the entitlement of precompact wells is a legal question.

(6) *Total Amount of Pumping.* Both states estimated the amount of water pumped primarily through the use of electric power records, although pumping from non-electric wells (natural gas, diesel, etc.) was also calculated. Total pumping for the 1950-85 period was estimated by Kansas to be 5,810,000 acre-feet; the Colorado figure for the same period was 5,227,000 acre-feet.

(7) *Computer Modeling and Depletions from Pumping.* Much of the trial was spent in highly technical disputes among experts concerning the various computer models that were used to isolate and estimate the impacts of pumping and the WWSP. Kansas experts, after making substantial revisions to the original hydrologic-institutional model, estimated total depletions of usable Stateline flow for the 1950-85 period from both pumping and the WWSP at 489,000 acre-feet. Colorado and the United States subjected the reliability of the H-I model to relentless attack, criticizing not only the data and assumptions used in the model, but also its basic structure. The United States questions whether the revised H-I model results meet threshold standards for admissibility. Colorado's own combined groundwater models and water budget analysis, however, also show substantial Stateline depletions from pumping. Colorado contends that upstream of John Martin Reservoir these depletions have been largely

offset by return flows from transmountain imports, and downstream by benefits from the 1980 plan.

(8) *Usable Flow.* Article IV-D of the compact provides that future development or construction shall not materially deplete the waters of the Arkansas River "in usable quantity or availability for use to the water users in Colorado and Kansas under this Compact." Kansas presented evidence on three alternate methods to reduce depletions of total Stateline flow to depletions of usable flow. Colorado experts raised objections to each, offered changed values for one methodology if it were to be used, but presented no usable flow analysis of their own after 1969.

(9) *Well Development in Kansas.* Colorado contends that Kansas' "predicament" is largely due to its own failure to regulate postcompact pumping in Kansas. The issues are whether pumping in Kansas affects water that comes within the provisions of the Arkansas River Compact, and whether users in Colorado are adversely impacted within the meaning of the compact by such postcompact pumping in Kansas.

(10) *Winter Water Storage Program.* The fundamental issue is whether the WWSP, which operated during 1976-85 except for 1978, caused material depletions of usable Stateline flow. Kansas claims that such depletions amounted to 40,000 acre-feet over the whole period of time. Both the United States and Colorado dispute this figure, claiming that the results of Kansas' modeling effort are not accurate or reliable, and that the program increased Stateline flows if accretions are considered. As subsidiary issues, Kansas maintains that Colorado used

the wrong period of time during which to analyze the program. Colorado simulated operation of the WWSP over the historic period of 1950-75. It did not analyze the program for the years when it was actually operated. Kansas, on the other hand, examined the years of actual operation, but assumed that the 1980 Operating Plan was not in effect during 1980-85. Both the United States and Colorado objected to this assumption. Finally, Colorado urges that Kansas has acquiesced in the development and implementation of the WWSP, and should not now be heard to complain.

SECTION VIII

BURDEN OF PROOF

A. The Issue.

There is no question of course that Kansas, as plaintiff, must prove its case. There is a serious question, however, concerning the relative weight of evidence which Kansas must produce to satisfy that requirement. Specifically, Kansas contends that it need meet only the "preponderance of the evidence" test applicable to ordinary civil litigation. Colorado and the United States, on the other hand, contend that the appropriate test is "clear and convincing proof." This controversy may be important because of the many factual issues in the case, especially the issues surrounding Kansas' effort to construct a computer model of the Arkansas River system and to demonstrate Stateline depletions through the use of that model.

B. Nebraska v. Wyoming.

Although it may be only dictum, the Supreme Court's unanimous decision last year in *Nebraska v. Wyoming*, 507 U.S. ___, 123 L.Ed.2d 317, 113 S.Ct. 1689 (1993), is so recent and so relevant that I necessarily take it as the starting point in determining the burden of proof Kansas faces in the present case. The Court has again stated its long-standing rule that in litigation within the original jurisdiction, a state seeking equitable apportionment of an interstate stream must present clear and convincing proof of some real and substantial injury or damage. (507 U.S. at ___, 123 L.Ed.2d 317 at 329, 113 S.Ct. 1689 (1993)

citing *Idaho v. Oregon*, 462 U.S. 1017, 1027, 77 L.Ed.2d 387, 397, 103 S.Ct. 2817 (1983); *Colorado v. Kansas*, 320 U.S. 383, 393, 88 L.Ed. 116, 123-24, 64 S.Ct. 176 (1943); *Connecticut v. Massachusetts*, 282 U.S. 660, 669, 75 L.Ed. 602, 607, 51 S.Ct. 286 (1931).

The *Nebraska* case involves a new refinement of the rule. The opinion states that where a Supreme Court decree has been issued in an interstate river apportionment case, a state instituting a later proceeding to *enforce* the decree need not meet the strict standard of proof applicable in the initial proceeding. 507 U.S. at ___, 123 L.Ed.2d at 330-31, 113 S.Ct. 1689 (1993). On the other hand, a high degree of proof will still be required of a party asking to *modify* such a decree, since a state proposing modification "essentially seeks a reweighing of equities and an injunction declaring new rights and responsibilities." *Id.* A resulting question addressed in the latest briefs in our own case is whether or not the Arkansas River Compact is analogous to a Supreme Court decree, so that Kansas' suit may be viewed as one to enforce the compact and therefore as a proceeding subject to a less demanding evidentiary test than clear and convincing proof.

C. Background.

In approaching this issue, two background matters should be noted.

First, what the Court in the *Nebraska* case refers to as the "legal standard" for litigation between states (that is, the requirement that the complaining state present clear and convincing evidence) is a latecomer on the scene. For

over a century following ratification of the constitution, the Court does not appear to have adopted any burden of proof rule applicable to all state-vs-state cases. In a number of the opinions in that period the Court commented on the strong showing required of a given state, but such remarks involved either particular types of disputes, e.g., *Virginia v. West Virginia*, 78 U.S. (11 Wall.) 39, 63, 20 L.Ed. 67, 73 (1871) (state action based on local election), or cases where the showing of an opposing state was especially strong so that the burden of proof was not significant. E.g., *Rhode Island v. Massachusetts*, 45 U.S. (4 How.) 591, 638, 11 L.Ed. 1116, 1137 (1846) (boundary); *Indiana v. Kentucky*, 136 U.S. 479, 518, 34 L.Ed. 329, 336, 10 S.Ct. 1051 (1890) (boundary); *Virginia v. Tennessee*, 148 U.S. 503, 523, 37 L.Ed. 537, 544, 13 S.Ct. 728 (1893) (boundary). *Missouri v. Illinois*, 200 U.S. 496, 521, 50 L.Ed. 572, 579, 26 S.Ct. 268 (1906), appears to be the first case to articulate this strict rule. Justice Shiras' 1901 opinion overruling the demurrer (180 U.S. 208, 248, 45 L.Ed. 497, 515, 21 S.Ct. 331) mentioned in dictum that, because Missouri sought an injunction based on nuisance, the evidence would have to be "determinate and satisfactory." But in 1906, after evidence was presented, Justice Holmes referred back to the Shiras "intimation" (200 U.S. at 518, 50 L.Ed. at 577) and went on to announce a burden of proof rule applicable generally to actions between states – "clearly and fully proved." 200 U.S. at 521, 50 L.Ed. at 579.

In hindsight, it is fair to observe that the evidence of river contamination in *Missouri v. Illinois* was very complex and controversial, and that it required no special burden of proof to deny relief. Nor was it necessary to state a rule going beyond the nuisance context. Moreover,

the only citation given in support of the new standard was the ruling on demurrer in *Kansas v. Colorado*, 185 U.S. 125, 46 L.Ed. 838, 22 S.Ct. 552 (1902), an opinion which did not make that point. And following trial, the final opinion in *Kansas v. Colorado*, 206 U.S. 46, 51 L.Ed. 956, 27 S.Ct. 655 (1907), also omitted reference to a strict burden of proof. Instead (206 U.S. at 97, 51 L.Ed. at 975), Justice Brewer stressed the equality of the two states:

> "One cardinal rule, underlying all of the relations of the states to each other, is that of equality of right. Each state stands on the same level with all the rest."

See also *Connecticut v. Massachusetts*, 282 U.S. 660, 670, 75 L.Ed. 602, 607, 51 S.Ct. 286 (1931).

Later litigation involving sewage and drainage (*New York v. New Jersey*, 256 U.S. 296, 309, 65 L.Ed. 937, 943, 41 S.Ct. 492 (1921); *North Dakota v. Minnesota*, 263 U.S. 365, 374, 68 L.Ed. 342, 345-46, 44 S.Ct. 138 (1923)), echoed the rule of *Missouri v. Illinois*, and by the time of *Colorado v. Kansas* in 1943 there was a line of similar precedents. 320 U.S. at 393, note 8, 88 L.Ed. at 124. The rule is now "longstanding." Yet there has been no real explanation of the suitability of a strict burden of proof for equitable apportionment cases.

Second, on an interstate stream, the downstream state will normally be the complaining party. As such it will also invariably be the party which is required to present a very strong case in order to obtain relief. In contrast to actions involving private water rights, the Court's special rule for burden of proof in equitable apportionment cases adds a significant legal inequality to

the natural inequality already imposed by geography. The ideal of federalism – that each state is on an equal footing with all the other states – seems poorly served by a rule which routinely penalizes all downstream states.

D. The Compact.

These background matters aside, I can see no reason why an interstate compact should have any less standing in this respect than a decree of the Court. It is often said that the Court's authority over the states is a substitute for the war and treaty powers which they possessed before adoption of the constitution (*Rhode Island v. Massachusetts*, 37 U.S. (12 Pet.) 657, 725, 9 L.Ed. 1233, 1260 (1838); *Kansas v. Colorado*, 185 U.S. 125, 140, 46 L.Ed. 838, 844, 22 S.Ct. 552 (1902); *North Dakota v. Minnesota*, 263 U.S. 365, 372-73, 68 L.Ed. 342, 345, 44 S.Ct. 138 (1923); *Idaho v. Oregon*, 462 U.S. 1017, 1031, note 1, 77 L.Ed. 2d 387, 400, 103 S.Ct. 2817 (1983)), but the compact alternative is no less effective a substitute for those powers and clearly is no less constitutionally authorized. A compact is approved by the legislatures of the affected states and by Congress. Indeed, the Court itself has frequently urged contending states to negotiate compacts *rather than* resorting to the jurisdiction of the Court. See *Colorado v. Kansas, supra*, 320 U.S. 383, 392, 88 L.Ed. 116, 123, 64 S.Ct. 176 (1943); *New York v. New Jersey*, 256 U.S. 296, 313, 65 L.Ed. 937, 945, 41 S.Ct. 492 (1921). Undoubtedly one reason for that admonition is that the compact procedure provides an important ingredient which the Court itself cannot provide – the consent of all the parties. Both Colorado and Congress consented to the rights and duties set forth in the compact; neither may now be heard

to claim that those rights and duties ought to be harder to enforce than they would be if contained in a decree of the Court.

E. "Enforcing" the Material Depletion Standard.

The Court's detailed discussion in *Nebraska v. Wyoming* indicates a willingness to consider individual provisions of the decree in terms of this enforcement-vs-modification analysis. 507 U.S. at ___, 123 L.Ed.2d at 330, 113 S.Ct. 1689 (1993). The decree in that case was much more detailed in its statement of rights and duties than the more general provisions of the Arkansas River Compact, but, as I conclude in my discussion of Article IV-D of the compact, I believe the agreed concept of material depletion is a meaningful and practical standard for dividing the resources of the river. Just as with a preexisting decree of the Court, the rights and duties stage of this dispute has been concluded; the present proceedings involve enforcement of those rights and duties.[27] Accordingly, the burden of proof which Kansas must now satisfy is the traditional one of ordinary civil litigation, that is, preponderance of the evidence.

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[27] The Supreme Court has jurisdiction to enforce an interstate compact, as well as to declare rights under the compact and to determine compliance. *Texas v. New Mexico*, 462 U.S. 554, 567, 575-76, 77 L.Ed. 2d 1, 103 S.Ct. 2558 (1983).

SECTION IX

BACKGROUND OF THE COMPACT

The meaning of the Arkansas River Compact cannot be fully understood apart from the rich history of controversy over the river, and the early efforts to apportion its waters between the two states. Nor can its meaning be divorced from the views of men in both states who fought the apportionment issues for more than a decade before taking seats on the compact commission to undertake formal compact negotiations.

The compact makes no specific quantitative allocation of river flows, either in amounts or in terms of shares in the supply. It does not specify how flows had been divided and used in the past. Nor does it make specific reference to the pumping of tributary groundwater from wells. And yet the compact relies upon continued agreement between the states in administering the compact to achieve its stated purpose, that is, to "Equitably divide and apportion" the river flows and the benefits arising from John Martin Reservoir. Article I-B. Under these circumstances, and as a supplement to the compact language and the record of compact deliberations, the background history becomes highly useful in helping to understand the intent of the compact commissioners. Certainly the compact was in part shaped by this history.

Kansas' first witness during the trial was Douglas R. Littlefield, Ph.D., a research historian and consultant. His qualifications, including numerous publications and awards, are set forth in Kansas' Exhibit 484. Dr. Littlefield began his work for Kansas in the spring of 1986. The result of that effort was a 462-page, two-volume report

entitled "The History of the Arkansas River Compact." Kan. Exh. 129. His review encompassed hundreds of thousands of pages of archival material.[28] Dr. Littlefield

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[28] The sources are described generally as follows: "Comprehensive research was undertaken at the National Archives (Washington, D.C.) in the records of the Bureau of Reclamation, the U.S. Geological Survey, the Department of the Interior, the U.S. Supreme Court, the Natural Resources Planning Board, and the Federal Power Commission. Other work was done at the Federal Records Center in Houston, Texas, in the records of the U.S. Army Corps of Engineers. Further research was conducted in the Kansas State Historical Society (Topeka) in the Kansas governors' papers between 1900 and 1950, in the personal papers of Congressman Clifford R. Hope (who represented western Kansas between 1927 and 1957), in the records of the Kansas State Board of Agriculture's Division of Water Resources, and in the Kansas attorney general's files (including the attorney general's records relating to *Colorado v. Kansas*). Additional work was undertaken at the Colorado Historical Society (Denver) in the records of the Arkansas Valley Ditch Association (which represented water users in Colorado's part of the river basin) and in the Michael C. Hinderlider Papers. (Hinderlider was Colorado's state engineer during much of the period under study.) Work was also done at the presidential library of Franklin D. Roosevelt in Hyde Park, New York, and in the presidential library of Harry S. Truman in Independence, Missouri. Research was also carried out at the University of Colorado (Boulder) in the personal papers of U.S. Senator Gordon L. Allott and Congressman Edgar J. Chenoweth, both from Colorado. (Allott was a prominent attorney from southeastern Colorado who served in the U.S. Senate from 1955 to 1973, and he was a law partner with Arthur C. Gordon, who

was on the witness stand for some twelve days, including extensive cross-examination. While Colorado disagrees with some of his conclusions, and while some of his opinions were stricken as legal conclusions, I believe that the accuracy and thoroughness of his historical presentation generally hold up well. Colorado offered no historical expert in opposition.

A. Early History.

Following Kansas' failure to gain more water from Colorado in the 1907 Supreme Court decision,[29] a number of private actions were filed against users in Colorado. One of these filed in 1910 by a Kansas plaintiff sought a

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represented the Fort Lyon Canal Company, a major Arkansas River water user. Gordon also served as a special assistant attorney general in *Colorado v. Kansas*. Chenoweth represented southeastern Colorado in the House of Representatives from 1941 to 1949 and again from 1951-1965.) Further archival work was undertaken in the files of the Arkansas River Compact Administration (the organization created by the compact to administer the agreement's daily operation) in Lamar, Colorado.

"In addition to research in these historical archives, more document review and analysis was done at Bureau of Reclamation's offices in Colorado, in Montana, and in Washington, D.C., and research was undertaken in Kansas state government offices in Topeka and Garden City. Finally, research was also conducted in many published primary sources, including Congressional reports and various state government publications." Kan. Exh. 129 at 12-13.

[29] *Kansas v. Colorado*, 206 U.S. 46, 51 L.Ed. 956, 27 S.Ct. 655 (1907).

decree establishing the priorities of individual diverters along the Arkansas River regardless of the boundary between the states.[30] The objective of this action contrasted sharply with the equitable apportionment between the two states sought earlier by the State of Kansas. The case was settled in 1916, giving the various Kansas ditches specific diversion rights with a priority date of 1910, the year the action was filed. Kan. Exh. 141. The various Kansas ditches had actually begun to take water in 1879 and in the early 1880s. Kan. Exh. 129, Vol. I at 37. However, the settlement essentially confirmed the use of water in the two states as it then existed. Future appropriations in Colorado were subordinated to the rights of the Kansas diverters. The Purgatoire River was then relatively unappropriated, and so future Colorado interference with that source of supply was checked. *Id.* at 36.

This settlement was rejected by Kansas' Finney County Water Users' Association (Farmers' Ditch), and in 1916 it filed its own action against Colorado users. The litigation was later expanded to include tributary users, and testimony was heard throughout the early 1920s. In 1921 another settlement approach was made. This stemmed from a letter from Delph E. Carpenter, a highly respected Colorado water lawyer, to the Kansas Attorney General. Carpenter proposed negotiating an interstate compact so that both the states and their users would be

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[30] *United States Irrigating Co. v. Graham Ditch Company, et al.*, Case 5578, U.S. District Court for District of Colorado; Kan. Exh. 129 at 33-34.

bound. As a result, both states passed legislation authorizing the appointment of a commission to negotiate a compact. Carpenter represented Colorado, and Kansas named George S. Knapp, who later became the Kansas Chief Engineer and head of its Division of Water Resources. Some 20 years later Knapp was to become the chairman of the Kansas delegation that actually negotiated the Arkansas River Compact. By 1925 Carpenter and Knapp had drafted a tentative compact which was submitted to irrigation interests in both states for their comments and recommendations. Kan. Exh. 144.

The proposed compact recognized that virtually all of the normal flows of the mainstem (not including irregular flood flows) were being diverted by Colorado ditches. It did not attempt to change that situation, and thus Colorado farmers would have assurances that their existing uses would not be subject to continued legal threats. As for Kansas' irrigation problems, Knapp and Carpenter tried to find a remedy through use of water from the Purgatoire River. Kansas was given the right to build a major reservoir on the Purgatoire in order to store up to 120,000 acre-feet of water. With certain minor exceptions, Kansas would have the right to this stored water, but subject to a reservation in favor of Colorado of 10,000 acre-feet for users in the Arkansas River Valley. Kan. Exh. 129, Vol. I at 42-43. However, according to Knapp, this reservation had been inserted for discussion purposes only and Knapp opposed it. *Id.* at 44. Whether as a result of this issue or not, the proposed compact went no further. Meanwhile the Finney County Water Users Association lawsuits continued to move ahead at a slow pace.

In 1928, therefore, the State of Colorado brought an action in the United States Supreme Court to enforce the earlier judgment in *Kansas v. Colorado*, and to halt the prosecution of the private litigation. That case was ultimately decided by the Court in *Colorado v. Kansas*, 320 U.S. 383, 88 L.Ed. 116, 64 S.Ct. 176 (1943).

B. Development of Caddoa Reservoir.[31]

The historic 1921 flooding of the Arkansas River, which caused extensive damage from Pueblo to Garden City, became the catalyst for yet another approach to solving the water problems of the two states.[32] The Colorado State Engineer, Michael C. Hinderlider, proposed the possibility of a reservoir on the mainstream near Caddoa. Hinderlider saw this facility as serving the dual purpose of flood control and also possibly helping to solve the interstate struggle over allocation. Colorado began preliminary studies on its own, but also sought federal involvement and support.[33] In the same general time frame, Colorado officials and water users were also

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[31] Named for the small town of Caddoa, Colorado, where the reservoir was proposed to be located. In 1940 the name was changed to John Martin Reservoir in memory of the Congressman who represented southeastern Colorado from 1909 to 1913 and again from 1933 to 1939, and who was highly influential in obtaining federal authorization and funding for the reservoir. Congressman Martin died in 1939. Kan. Exh. 208, Consent Decree at 5.

[32] See pages 47-49 of Kan. Exh. 129, Vol. I, for photographs of the 1921 flood damage.

[33] Colorado's Caddoa Dam survey was completed by Hinderlider in 1928. Kan. Exh. 129, Vol. I at 53.

exploring additional transmountain diversions in order to augment their irrigation supplies.[34] To some extent, these transmountain plans competed with the Caddoa project for support and funding.

Efforts to obtain federal funding for the Caddoa project were marshalled through a Caddoa Dam Committee organized in 1933. This committee included not only high ranking Colorado officials but also influential representatives of water users. Among these was Henry C. Vidal, a Denver lawyer who represented the Arkansas Valley Ditch Association. Vidal was also one of Colorado's attorneys in *Colorado v. Kansas*, and later became chairman of the Colorado delegation to the commission that negotiated the Arkansas River Compact.

The committee recognized that federal aid was unlikely unless the Caddoa project also had Kansas' support. Kan. Exh. 129, Vol. I at 64-66. Negotiations with Kansas were again resumed. Colorado representatives were prepared to give assurances that the new reservoir could not be used to bring new lands under irrigation.[35]

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[34] That effort eventually led to the Bureau of Reclamation's Fryingpan-Arkansas Project in 1962. Public Law 87-590, 87 Cong., 2d Sess. (Aug. 16, 1962), 76 Stat. 389.

[35] A 1933 report by Hinderlider stated that about 325,000 acres in Colorado were irrigated from the Arkansas River downstream of Pueblo. Kan. Exh. 162. He put the Kansas acreage at approximately 65,000 acres. *Id.* A report from the Kansas Attorney General to the Governor, also in 1933, estimated that Kansas ditches had been receiving on average about 60,000 acre-feet of water annually from the river to irrigate 70,000 acres of land. Kan. Exh. 155. Knapp understood, however, that a prohibition against new irrigated acreage would not necessarily limit water

Kan. Exhs. 150, 153, 163-65, 129 at 78-79. But Kansas was seeking more, namely, a definite allocation of the flows below the reservoir. Kan. Exhs. 153, 157, 158. A tentative accord acceding to Kansas' demands was reached at a September, 1933 meeting in Wichita. Principal participants at this meeting included Vidal, Knapp and C. L. Patterson who later became the Chief Engineer for the Colorado Water Conservation Board. Patterson, along with Vidal and Knapp, was also appointed later to the negotiating commission for the Arkansas River Compact. After further negotiations, the agreement was finalized in writing on December 18, 1933.

C. Stipulation of 1933.

The agreement of December 18, 1933 was drafted in the form of a stipulation to be filed in the pending *Colorado v. Kansas* litigation. Kan. Exh. 167. However, the stipulation was not to be filed until construction of Caddoa Dam and Reservoir was assured. Each state pledged to use its influence so far as practicable to obtain construction of the reservoir by the United States, and the water allocation provisions of the stipulation were to become effective only when Caddoa Dam had been constructed and water was stored in the reservoir. *Id.* at 3, 5.

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use in Colorado. He noted that water use could be increased through wells. Moreover, many farmers in Colorado did not have sufficient water to irrigate all of their land each year. Consequently one field would be watered one year and another the next. If water could be obtained, the amount of land actually irrigated in any given year could be increased without showing any increase in "irrigated acreage." Kan. Exh. 205.

The stipulation was also made without prejudice to the claims of either state in *Colorado v. Kansas*, and was specifically made subject to the decision of the Supreme Court in that case. *Id.* at 5.

The stipulation provided that construction and operation of Caddoa should not "disturb the status quo of the diversion of water for beneficial uses from said Arkansas River by the ditches and canals now constructed and operated in both of the States of Colorado and Kansas." *Id.* at 3. In order to "maintain the status quo," Kansas was allocated 77,000 acre-feet annually at the Stateline. 52,000 acre-feet were to be delivered during the irrigation season from April 1 to October 1, with the remaining 25,000 acre-feet being delivered during the nonirrigating season. *Id.* at 3. For the irrigation of lands in Colorado located below the reservoir, 160,000 acre-feet annually were allocated to Colorado. These allocations applied to the normal flows of the Arkansas River that were to be released through the new reservoir, and corresponded generally to the amounts of water that had been used. Kan. Exh. 129, Vol. I at 83-84. Any shortages were to be prorated between the states in proportion to their respective allocations. The "additional water" to be stored in the reservoir was said to constitute "surplus" and was allocated one-half to Colorado and one-half to Kansas. Kan. Exh. 167 at 4. Release of such stored water was not considered part of the specific acre-feet allocations made to the states.

Caddoa Dam and Reservoir were authorized by Congress in 1936, and full funding for the project was provided in 1938. Kan. Exhs. 182, 183, 129, Vol. I at 106-07.

D. Proposed Consent Decree in Colorado v. Kansas.

Despite the cooperative efforts between the states in support of the Caddoa project, proceedings in *Colorado v. Kansas* continued to move slowly. Testimony was taken from 1932 to the end of 1939.[36] Kan. Exh. 129, Vol. I at 122, 125. In 1937, however, counsel for the two states, A. W. McHendrie for Colorado and W. E. Stanley for Kansas, began to discuss settlement. McHendrie initially proposed a consent decree in the Supreme Court action based upon the stipulation of 1933. *Id.* at 126. McHendrie thought that such a settlement would be fair and would give the Kansas ditches ". . . a controlled supply of water equal to that which they had been getting throughout their history." *Id.* at 127.

Stanley, however, believed that the 1933 stipulation was only an interim measure and that Kansas was entitled to larger flows under any permanent settlement. He wanted to see the 77,000 acre-feet allocation in the 1933 stipulation increased to 100,000 acre-feet. Nonetheless, negotiations proceeded and ultimately the settlement assumed a different form. Based on agreement among counsel, McHendrie and Henry C. Vidal in 1941 prepared a Stipulation and Final Decree, generally referred to as a Consent Decree, to be filed in the Supreme Court proceedings. Kan. Exh. 208.

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[36] The record consisted of 36 volumes of testimony and some 316 exhibits. Kan. Exh. 129, Vol. I at 125.

The proposed decree provided that Kansas would get 25% of the streamflows of the Arkansas and Purgatoire Rivers between April 1 and September 30, as measured near Parkdale, Colorado (above Pueblo at the head of Royal Gorge), and at the mouth of the Purgatoire. This share of river flow was in contrast to the acre-foot allocation included in the 1933 stipulation, although Littlefield testified that the 25% figure was in fact based upon the amounts that had been flowing into Kansas. RT Vol. 4 at 46. Measuring the Kansas share upstream protected it against intervening development and served the same purpose as the guaranteed amount under the 1933 stipulation. Any imported water was not to be counted in determining the Kansas share.

During winter months, Kansas was to have 25% of the total flows up to 25,000 acre-feet, plus water for storage at Lake McKinney. Kansas could elect to store any of its waters at John Martin Reservoir, provided that it did not use more than one-third of the total conservation pool. The Kansas allocation was measured at the State-line, subject to certain corrections. Flows over 2,000 cfs, and volume of more than 25,000 acre-feet in any winter season, were considered "undivertible" and were not chargeable against Kansas.

Although the proposed consent decree had been prepared by Colorado's attorneys in *Colorado v. Kansas*, and was quickly approved by the Finney County Water Users' Association and Kansas' Associated Ditches, it was opposed by C. L. Patterson, the Chief Engineer for the Colorado Water Conservation Board. Patterson prepared an extensive analysis, including a great deal of water supply and usage data, which is in evidence as Kansas

Exhibit 208. A copy of the proposed consent decree is attached to Patterson's analysis. Essentially, Patterson believed that the consent decree awarded too much water to Kansas, and would require existing Colorado uses to be cut back. Kansas, he thought, would be assured of "largely increased supplies of usable water" and "all the conservation benefits of Caddoa Reservoir." Kan. Exh. 208 at 3, 5. On the other hand, it would "require limitations upon diversions and uses heretofore and now being made by Colorado appropriators." *Id.* at 5.

Patterson noted that the allocation in the 1933 stipulation, in contrast, "will not disturb the status quo of diversions in either State." *Id.* at 9. The 1933 stipulation also divided the quantities of water conserved from streamflows previously wasted, "in addition to the supplies required to maintain the status quo of downstream diversions." *Id.* at 10. Patterson maintained that during the 1908-38 period, ditch diversions in Kansas averaged 84,500 acre-feet per year. *Id.* at 36. He noted that these historical averages were approximately the same, although slightly greater than the "status quo" values used in the 1933 stipulation. *Id.* For this same 1908-38 period, his data indicated that 740,000 acre-feet, or 74% of the total water available, was consumptively used in Colorado.

Based upon Patterson's views, the Arkansas Valley Ditch Association in Colorado rejected the proposed settlement. This action was taken despite strong support from Henry C. Vidal in favor of the proposed consent decree. Kan. Exh. 209. Vidal pointed out that the Supreme Court proceedings involved a determination of the

respective rights of the two states in the equitable benefits of the Arkansas River, "whether measured by actual quantities of water or otherwise . . ." *Id.* at 3. More than a mere division of benefits of Caddoa Reservoir was involved. In his opinion, the proposed consent decree was "the most favorable Colorado can get and should be approved." *Id.* at 8.

While the Arkansas Valley Ditch Association in Colorado rejected Vidal's recommendation, it still encouraged talks to continue toward a more acceptable decree. As a result, Colorado officials met again in March, 1942. Those present included Colorado Governor Ralph Carr; Attorney General Gail Ireland; Colorado Water Conservation Board Director Clifford H. Stone; Stone's legal counsel, Jean S. Breitenstein; Stone's Chief Engineer, Charles Patterson; and Attorneys Arthur Gordon, A.W. McHendrie, and Henry Vidal. All except the Governor were subsequently involved in the compact negotiations, either as commissioners or as advisors.

Negotiations were in fact renewed. Colorado pressed for modifications in the consent decree, lowering the amount of storage capacity in John Martin Reservoir used by Kansas, and seeking the right of Colorado to construct additional reservoirs upstream from John Martin, subject to protections for Kansas. Kan. Exh. 212. However, the changes were not acceptable to Kansas. Kan. Exh. 213. A final effort at settlement was then made by Patterson, who developed a proposal known as "Patterson's Plan F." Kan. Exh. 214. Plan F still dealt with apportionment of the flows historically diverted in the two states, together with a division of the flows to be conserved by John Martin. Kan. Exh. 129, Vol. I at 153-158. However, this plan also

was rejected by Kansas. *Id.* at 159. Under Plan F, Stateline flows in excess of 2,000 cfs during the summer, or 40,000 acre-feet per month, or 160,000 acre-feet per season, were not considered usable and were not charged against the Kansas allocation. *Id.* at 157. As to further upstream development in Colorado, Plan F provided that:

> "[E]nterprises constructed in Colorado in the future shall not divert or store waters of the interstate stream under priorities or decrees dated hereafter except at such times as the conservation pool in Caddoa Reservoir is filled to within 40,000 acre feet of its water holding capacity . . ." *Id.* at 158.

E. The Supreme Court Decision in Colorado v. Kansas.

Time finally ran out on the efforts to agree upon a consent decree. Charles L. Cavanah, the Special Master appointed to hear the case, made his recommendations to the United States Supreme Court on May 1, 1943. Kan. Exh. 215. In a cryptic series of findings without discussion of the evidence, the Special Master found that the "average annual dependable and fairly continuous water supply" of the Arkansas River and its tributaries amounted to 1,110,000 acre-feet. *Id.* at 10. Of this flow, he awarded 925,000 acre-feet to Colorado, and 185,000 acre-feet to Kansas. *Id.* at 11-12. When flows either exceeded or fell short of the dependable average, the allocations were to be prorated. Both states filed exceptions to the Master's recommendations. Kansas was ready to accept the 185,000 acre-feet per year allocation since it was well beyond what had been sought in previous negotiations.

Nonetheless, Kansas objected to its inability to obtain water when the users demanded it. Colorado, as might be expected, objected to the basic apportionment itself and argued that the proposed allocation would cause serious damage to its interests.

The Court found that the Master had erred in attempting to divide what he designated as the "average annual dependable" water supply. Kan. Exh. 216 at 392. The Master did not define floodwaters or the extent to which they were unusable by either state. Nor did the Master suggest any provision whereby the occurrence of floodwaters could be taken into account in defining Colorado's obligation to deliver water to Kansas. *Id.* at 390. The critical matter, said the Court, is:

> ". . . the amount of divertible flow at times when water is most needed for irrigation. Calculations of average annual flow, which include flood flows, are, therefore, not helpful in ascertaining the dependable supply of water usable for irrigation." *Id.* at 397.

Of more importance, the Court found that Kansas had not sustained its allegations that Colorado's use of water had materially increased, and that the increase had worked a serious detriment to the substantial interests of Kansas. *Id.* at 400. While the Master had found a material increase in river depletions by Colorado, his report did not state what he considered material, or the extent of the diminution of flow, or the interests of Kansas which had been injured and the extent of the injury. In reviewing the evidence, the Court found that it did not support a depletion in *usable* flows. *Id.* at 396, 398. The Court noted that the Kansas ditches were capable of diverting water only

up to 2,000 cfs. *Id.* at 396. Pointing out that irrigated acreage in Kansas had also increased, the Court did not find the requisite showing of serious injury. The Court mentioned the "great quantities of ground water" available in Kansas, but did not discuss the source or replenishment of such groundwater, nor any consideration of overdraft. *Id.* at 399.

Except to enjoin further proceeding in the private litigation, the Court denied relief.[37] Perhaps quietly recognizing that the maximum benefits from John Martin could be realized only by agreement, the Court directed the states back to the compact approach:

> "Such [interstate water] controversies may appropriately be composed by negotiation and agreement, pursuant to the compact clause of the Federal Constitution. We say of this case, as the court has said of interstate differences of like nature, that such mutual accommodation and agreement should, if possible, be the medium of settlement, instead of invocation of our adjudicatory power." *Colorado v. Kansas*, 320 U.S. 383 at 392.

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[37] According to one of the recitals in the proposed consent decree, Colorado in its bill of complaint had sought an "equitable apportionment and division of the benefits of the water of said Arkansas River and its tributaries . . . ." Kansas filed an answer and cross-bill for a determination of its share of the total water supply to be delivered at the Stateline. Kan. Exh. 208, Decree at 3.

F. Interim Operating Agreements, 1943-47.

By December of 1942, the year before the Supreme Court decision in *Colorado v. Kansas*, construction of John Martin Reservoir had proceeded far enough to allow limited conservation storage to begin. By March, 1943 some 40,000 acre-feet were in storage. Kan. Exh. 129, Vol. I at 168. Absent an agreement between the states, the Corps of Engineers intended to release this water. Responding to this pressure, Knapp and Hinderlider met with the Corps to discuss rates of release and a division of the stored water between Colorado and Kansas. By April 1943 the states agreed that the 1933 stipulation had become effective, since *Colorado v. Kansas* had not yet been decided. *Id.* at 170. Water then in storage was considered as direct streamflow and was divided 67.5 percent to Colorado and 32.5 percent to Kansas. Kan. Exh. 217.

In the following years until adoption of the Arkansas River Compact, additional agreements were made. The 1933 stipulation expired by its terms when the Supreme Court decision in *Colorado v. Kansas* was issued in December 1943. Subsequent agreements were often difficult to reach, but without agreement the parties were under threat that the Corps would simply release water from John Martin Reservoir, or even refuse such storage. The various proposals, negotiations and interim agreements are discussed in detail in Kan. Exh. 129, Vol. I at 162-215.

At times negotiations were in the hands of many of the leaders who later became compact commissioners.[38] At one time, when negotiations stalled, the two governors stepped in. Patterson, Vidal and Ireland all had separate plans, but none were acceptable to Kansas. The agreement for 1944-45, at the suggestion of Knapp, was finally patterned after the 1943 agreement. One-half of the water in storage was allocated to Kansas, together with the return flows and tributary inflow originating below John Martin Reservoir. Kan. Exh. 129, Vol. I at 200.

The last of these interim agreements was negotiated by William E. Leavitt (for Kansas) and H. B. Mendenhall (for Colorado). *Id.* at 210. Both of these men had been appointed as compact commissioners, and the compact negotiations were then underway. The Leavitt-Mendenhall accord provided that winter storage would begin November 1, 1946 and last until April 1, 1947. During this period of time, ditches in Colorado could call for water to be released from John Martin Reservoir for winter irrigation at flows not to exceed 100 cfs. However, any such winter releases were deducted from Colorado's share of summer storage releases. With some variations, stored waters were basically apportioned 600 cfs to Colorado and 400 cfs to Kansas. This ratio represented an adjustment from the traditional 67.5/32.5 division first established in the 1933 stipulation and used in earlier interim

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[38] In the spring of 1944, Attorney General Mitchell, Knapp and Roland H. Tate, the attorney for the Kansas Associated Ditches, were all involved on behalf of Kansas. For Colorado, their representatives included Attorney General Gail Ireland, Patterson and Vidal. All six of these persons became compact negotiators. Kan. Exh. 129, Vol. I at 176.

operating agreements. It was noted by Hans Kramer, the federal delegate to the compact deliberations, that the modification had been made at the suggestion of Charles Patterson to compensate for increased diversions in Colorado beyond the de facto status quo of 1943. *Id.* at 212-13.

The summer portion of the 1947 operating agreement provided that between April 1 and October 31, the Corps of Engineers would impound all flows exceeding 750 cfs. Of flows below that rate, Colorado would receive the first 500 cfs and Kansas the balance. Recognizing that the compact talks could extend into 1948 and beyond, Leavitt and Mendenhall also agreed that the terms of the 1947 agreement would continue to be used until a compact was reached, subject to the right of either state to cancel the interim accord in any year. *Id.* at 212-14.

G. Conclusions.

Throughout the many agreements and efforts to reach agreement between the states, certain principles appear fairly consistently. The first is the continuing effort to maintain the status quo, as it existed from time to time. This concept related to diversions by the ditch companies in both states, and to the acreage irrigated by them. None of the river allocations was intended to provide water to bring new lands under irrigation. But neither were they expected to deprive users of their existing supplies. While the Kansas allocation of the river was sometimes defined in terms of a specific acre-foot quantity, and sometimes as a percentage of river flow, and sometimes merely as a curb on future Colorado use, the objective was essentially the same. That is, the efforts

were generally to confirm, and to protect against future erosion, the de facto apportionment of river flows that had occurred.

Both states needed additional water even for currently irrigated lands. However, these needs were to be met insofar as possible from the construction of reservoirs to store floodwaters that would otherwise be lost. Primarily, of course, the states were dealing with John Martin Reservoir. Both states were to share in that new conservation storage, and this division was to be in addition to the apportionment of normal streamflows. Neither state contemplated that Kansas' share of conservation storage in John Martin Reservoir would be in lieu of its proper apportionment of the normal flows of the Arkansas River.

SECTION X

ARKANSAS RIVER COMPACT NEGOTIATIONS

Federal approval for negotiations of the Arkansas River Compact was enacted by Public Law 34, 79th Congress, approved April 19, 1945. The statute authorized Colorado and Kansas ". . . to negotiate and enter into a compact not later than January 1, 1950, providing for an equitable division and apportionment . . . of the waters of the Arkansas River and all of its tributaries . . ." Jt. Exh. 3 at 1-4. The legislation also directed the president to name a federal delegate to the compact negotiations, and on November 20, 1945, President Harry S. Truman appointed Hans T. Kramer as the federal representative. Jt. Exh. 3 at 1-3. Kramer was a retired Brigadier General with the Corps of Engineers and had served as a district engineer of the Corps in New Mexico.

The Colorado appointments to the commission were made by the Governor of Colorado on January 12, 1945, pursuant to legislation adopted in 1937. Jt. Exh. 3 at 1-5, 6. The initial Colorado appointees were: Henry C. Vidal, who represented the Arkansas Valley Ditch Association and had participated in *Colorado v. Kansas;* Charles Patterson, Chief Engineer of the Colorado Water Conservation Board; Gail L. Ireland, who had been Attorney General; and Harry B. Mendenhall, who was closely associated with the water users above John Martin Reservoir.

The Kansas appointments were authorized by legislation approved February 28, 1945 and the Kansas Governor made his appointments on March 7, 1945. Jt. Exh. 3 at 1-7, 8. The Kansas commissioners were: George S. Knapp, Chief Engineer of the Division of Water Resources; A. B.

Mitchell, Attorney General; Roland H. Tate, an attorney for the Garden City Company and Kansas' Associated Ditches and an early pioneer who was "born practically on the banks of one of those [Kansas] canals";[39] and William E. Leavitt, who was employed by the United States Irrigating Company. Mitchell was later replaced by Attorney General Edward F. Arn.

The compact commission held 17 meetings. The first meeting took place in Denver on January 7, 1946, and the last on December 13-14, 1948. The official "Record of Meetings" of the Arkansas River Compact Commission is in evidence as Jt. Exh. 3. In addition, a transcript of each meeting was made by a court reporter. The transcript was obtained from General Kramer's files in the National Archives, and is Joint Exhibit 4. The deliberations of the commission were closed to the general public, although certain key individuals were invited from time to time to attend and speak, and various drafts of compact articles were circulated for comment outside of the commission. General Kramer was elected chairman at the first meeting of the commission.

A. The Development of Article IV-D.

For purposes of this case, Article IV-D is the most significant compact provision. The basic issues remaining for this part of the Report are whether postcompact pumping in Colorado and the Winter Water Storage Program violated Article IV-D. This Article provides:

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[39] Jt. Exh. 15 at 20.

> "This Compact is not intended to impede or prevent future beneficial development of the Arkansas River basin in Colorado and Kansas by Federal or State agencies, by private enterprise, or by combinations thereof, which may involve construction of dams, reservoir, and other works for the purposes of water utilization and control, as well as the improved or prolonged functioning of existing works: Provided, that the waters of the Arkansas River, as defined in Article III, shall not be materially depleted in usable quantity or availability for use to the water users in Colorado and Kansas under this Compact by such future development or construction."

The first true draft of this Article appears to have been prepared by Kramer after the twelfth meeting of the compact commission, and distributed to the other commissioners by letter dated February 20, 1948. Kan. Exhs. 257, 258, 129 at 347-48. At that time, the Article was numbered IV-F. It was renumbered as IV-D at the fifteenth meeting of the commission. Kan. Exh. 129 at 375, 377. The initial version was modified several times. Indeed, the last change occurred at the seventeenth and final meeting of the commission. Jt. Exh. 4 at 17-30. However, the essence of the proviso, namely, that there would be no material depletion of usable flows, remained constant.

B. Federal Development Plans.

Somewhat surprisingly, one of the major concerns during the first year of the compact negotiations dealt with the development plans of the federal government.

Article IV-D ultimately became the vehicle for addressing these issues.

In January, 1946 the Bureau of Reclamation released an ambitious report for the future development of the Upper Arkansas River. Kan. Exh. 241. Not only did the United States propose to integrate John Martin Reservoir into the Gunnison-Arkansas Project, but new reservoirs and developments, including power projects, were planned for the St. Charles, Huerfano, Apishapa, Fountain and Big Sandy Creeks, and for the Purgatoire River. These are all major tributaries to the mainstem of the Arkansas River in Colorado. A map showing the proposed development sites is included in Kansas Exhibit 129 at 265. Moreover, the federal plans called for the construction of wells "along the Arkansas River and elsewhere" in order to supply more irrigation water. Jt. Exh. 3 at 3-10. Imported water from the west side of the Rockies was expected to provide supplemental water for existing irrigated lands, and also to enable "the irrigation of a large area of new land." *Id.* at 3-9.

The compact commissioners were not unresponsive to the benefits that might result from appropriate federal development. But they also recognized that many of the federal goals ran counter to any compact that would maintain the status quo as to existing diversions and that would divide the benefits of floodwater conservation in John Martin. The commission tried a number of different approaches in an effort to reconcile future federal projects with protection to existing users. The earliest approach, suggested by Kramer, was to give the Arkansas River Compact Administration the right to comment on federal plans under the Flood Control Act of 1944. Jt. Exh. 3 at

5-19. That law made irrigation the primary use of water (as opposed to power development) and gave the states only the opportunity to comment on federal projects, and not the power to veto them. Kan. Exh. 129 at 256, 268.

Another method considered was the so-called "paramountcy" clause. Under this provision, upon ratification of the compact by Congress, the United States would be prevented from operating hydroelectric power plants or other works that would "conflict" with any irrigation or other consumptive use, present or future, in either state. *Id.* at 287, 256-57. Another alternative was the creation of a strong Arkansas River Compact Administration that would have authority through the paramountcy clause to pass judgment on future federal development proposals. *Id.* at 258. Another draft article at one time provided that water used by future development projects would be chargeable against the allocation of the state where the project was located. *Id.* at 287; Jt. Exh. 3 at 7-5. Draft Articles X and XI were the sections that included these various approaches.

Consideration of these issues did not occur without much discussion and correspondence with federal officials. However, by the twelfth meeting of the commission in February of 1948 still no language acceptable to both the federal government and the commission had been found. The commission decided therefore not to pursue Articles X and XI any longer. Jt. Exh. 3 at 13-5 to 13-9.

The issue of future federal construction, however, was not dropped. A draft Article IX then addressed a specific federal dam to be built near the mouth of the Purgatoire River. Kan. Exh. 129 at 336. Kramer, at the

same twelfth commission meeting, said that they needed to expand protection beyond the Purgatoire, that they should be concerned about "the effect of any upstream construction on the amount of water that reaches Caddoa." Jt. Exh. 4 at 12-53, 12-96. He suggested to Kansas that if it wanted "to protect or maintain the status quo" that Kansas itself "pick up the ball." Jt. Exh. 4 at 12-57. Kansas apparently responded with a rough draft of a compact that was later circulated to the commissioners, but does not appear in the official record of the commission meetings. Kan. Exh. 253, 257. The first time a full draft of the compact is set forth in the official record is in the record of the thirteenth meeting. Jt. Exh. 3 at-13-18 to 13-26.

Article IX had been reserved for the new reservoir near the mouth of the Purgatoire River. On the Kansas draft, however, that page bears the handwritten note: "Draft to be prepared by Kansas to cover general situation of depleting inflow to Caddoa." Kan. Exh. 253. It appears that Tate prepared a pencil draft which he gave to Kramer. Colo. Exh. 649; RT Vol. 13 at 45-47. In turn, Kramer "roughed out a preliminary draft" that was intended to permit future development with "adequate protection to John Martin Reservoir and the interstate compact apportionment," and sent it to Tate. *Id.* Kramer labeled the new Article as IV-F since he thought the subject fitted more naturally under Article IV. The draft Article IV-F was then sent by Tate to Secretary Noe for transmission to the other commissioners, which apparently occurred on February 20, 1948. Colo. Exh. 651; Kan. Exhs. 255, 257, 258, 129 at 347-48. That draft of what was to become Article IV-D read:

> "Future beneficial development of the Arkansas River Basin by Federal or State agencies, by private enterprise or by combinations thereof, may involve the construction of dams, reservoirs and other works for the purpose of comprehensive and coordinated water utilization and control as well as for the improved or prolonged functioning of existing works. This Compact is not intended to impede or prevent such beneficial development; provided, that the water herein apportioned between the States shall not be materially depleted in usable quantity nor adversely affected in seasonal availability without compensatory benefits to the water users in Colorado and Kansas under this Compact."

Thus, for the first time in the compact drafts, protection against material depletions addressed all future development, by the federal government or otherwise.

C. "Materially Depleted."

In its initial form Article IV-F provided that the water apportioned between the states would not be "materially depleted" by future development. Kan. Exh. 258. However, language developed by Vidal, Ireland and Kramer removed the qualification that any proscribed depletion be "material." Jt. Exh. 3 at 13-65. The modified proviso as it appears in the official record of the thirteenth meeting read:

> ". . . provided, however, that the water herein apportioned between the states shall not thereby be depleted in usable quantity or availability . . . ." *Id.* at 13-62.

The Colorado representatives and Kramer also deleted the phrase that flows would not be depleted "without compensatory benefits." Kan. Exh. 258; cf. Jt. Exh. 3 at 13-62.

In connection with these changes to Article IV-F, the commissioners discussed the meaning of the term "depleted" and what should be the yardstick for determining depletions. Vidal said that "depleted" meant the same as "diminished." Jt. Exh. 3 at 13-67. Kramer argued that any depletion should be measured against the "dependable or historic average of the flow at Caddoa." *Id.* at 13-69. Ireland agreed on the use of an average, that is, the flows that Caddoa would have impounded if upstream works had not been built. *Id.* at 13-66. Kramer also concurred in the use of a long-term average. *Id.* Knapp suggested using the same 35-year base period adopted by the engineering committee (1908-1942) but the idea of settling upon specific years was rejected by the others. There was no disagreement, however, with the principle that depletions would be determined on the basis of average prior flows. Kansas cautions, however, that the compact actually protects the "availability" as well as the amount of usable flow. Kansas argues that, in determining depletions, modern computers allow sophisticated techniques that were unavailable to the compact negotiators.

The term "materially" was reinserted in what was then Article IV-D at the seventeenth and final meeting of the compact commission. The request came from Mendenhall to remedy what he called a local situation in Colorado Springs. A reservoir there had developed a 6 cfs leak. The local people wanted to be sure that these flows

could again be impounded after repairs had been made. Jt. Exh. 4 at 17-30. Tate said it made no difference. "We have had it [material] in and out." *Id.* Kramer agreed, but on reflection he thought it might be better to restore the term. Otherwise, he said, "one teaspoonful of depletion might be interpreted too literally." *Id.* The use of "material" would avoid "an extreme interpretation." *Id.* There being no disagreement, "materially" was reinserted in the final form of the Article IV-D proviso.

Federal officials were also satisfied with this method of dealing with future construction, although the Article encountered some opposition among Colorado users who wanted to be able to claim a larger share of the river. Kan. Exhs. 274, 275; Jt. Exh. 3 at 13-106; Kan. Exh. 129 at 368-73.

D. Protection of Existing Uses.

Article IV-D clearly embraces new construction, but another part of the broader intent was to secure the existing supply of water for lands then irrigated and the existing division of that supply. In the discussions about Articles IV-F and IV-D, commissioners from both states were in easy agreement about their intent to maintain the status quo. Vidal said, "We are compacting about the present existing situation"; "We are trying to preserve a status quo." Jt. Exh. 4 at 12-54, 56; Jt. Exh. 3 at 13-100. Knapp concurred, emphasizing the need to be assured ". . . that the present conditions on the river will not be disturbed by the possibility of consumptive uses upstream." Jt. Exh. 4 at 12-54, 55. He pointed out that "The more consumptive use you build up upstream, the

less water will be present downstream from the same original water supply." *Id.* at 53-54. General Kramer put it more dramatically, noting that the Article permitted "new uses" but subject to ". . . keeping sacred the available water supply that is set up by the Compact." *Id.* at 17-37. Kansas interprets this emphasis on protecting the status quo as giving it a right to the amount of water used historically on approximately 70,000 acres of land that were irrigated by surface diversions and alluvial pumping developed as of 1948. Kan. Pre-trial Statement at 30.

The commissioners recognized the need to protect the supply flowing into Caddoa. In response to a question from one of the Bureau of Reclamation officials, Vidal said, ". . . it was our purpose to protect the situation with which we are dealing, namely the supply of the river at Caddoa, and a division and allocation thereof." Kan. Exh. 129, Vol. II at 365. Mendenhall, Kramer and Knapp also voiced the importance of protecting the flows into Caddoa. *Id.* at 364; Jt. Exh. 4 at 12-52, 53. Knapp described the water supply at Caddoa, together with the river gain below Caddoa at the Stateline, as the "basis of the apportionment in the Compact." Jt. Exh. 3 at 13-73. He said that Article IV-F (the forerunner of IV-D) would prevent depletion of that supply by "over-diversion." Jt. Exh. 3 at 13-101. Tate expressed the need to protect the present supply of water from depletion ". . . in anywise by some new developments or additional users." Jt. Exh. 4 at 12-102.

It is significant that the extensive record of compact negotiations does not reflect, at least insofar as I have been able to find, discussion of the extent of pumping that was then occurring in Colorado. The attention of the

compact commissioners was focused entirely on surface diversions by the various ditch companies. Protection of their supplies, limits on new ditches or diversions, limits on increased diversions – these were the issues. The engineering committee gathered and presented extensive data for the period 1908-42. These data included monthly streamflow measurements at nine stations along the river; monthly measurements of diversions in both Colorado and Kansas; transmountain imports; surface storage calculations including temperature, wind velocity, humidity, precipitation, and evaporation; and reservoir sedimentation studies. The committee's report specifically stated that irrigation supplies derived from pumping in both states were not included in the tabulated diversions. Jt. Exh. 5 at 3.

Current well pumping in Colorado appears simply not to have been a matter of concern to the compact commissioners. Had pumping been of any appreciable magnitude, I cannot believe that such use of water would not have surfaced in the engineering committee report and the compact negotiations. Absence of such discussion leads to the conclusion that pumping at that time was not large, a conclusion which is supported by other evidence in the case. Certainly, the compact commissioners did not foresee the technological breakthrough of the turbine pump and other conditions that led to the great increase in pumping which began in the 1950s. That is not to say that the compact language is not broad enough to cover depletions caused by pumping. I believe that it is, and that the intent of the commissioners was to protect against material depletions from any cause. However, during the compact negotiations the specific threat

appeared to be from future construction of dams and reservoirs, not from pumping.

The Kansas commissioners understood that under the compact and with the construction of John Martin Reservoir, Kansas was ". . . going to get a lesser supply of water, but with somewhat better usability." Jt. Exh. 4 at 17-33, 34. This was Knapp's comment at the final and seventeenth meeting of the commission after noting that Stateline flows over the 1908-42 period had averaged 280,000 acre-feet per year. Of course, this average included unusable flood flows. Comparisons of precompact and postcompact Stateline flows need to take these differences into account.

E. Article V on Apportionment.

A stated purpose of the compact is equitable apportionment of the waters of the Arkansas River, as well as the benefits arising from the construction, operation and maintenance of John Martin Reservoir. Article I-B. This goal is specifically addressed in Article V. Littlefield devoted a large part of Vol. II of his report to the negotiations leading up to this Article, which he described as "an immensely complicated task." Kan. Exh. 129, Vol. II at 392. However, the trial focused on Article IV-D, and the provisions of Article V warrant only a brief review.

The basic task undertaken by the commission in Article V was to determine what the existing division of river flows had been, and to develop a methodology for carrying that apportionment forward. Also the benefits of the new conservation in John Martin Reservoir had to be allocated. With respect to normal flows, the protection of

the status quo remained a dominant consideration. In Patterson's words, the important quantities of water were those that "heretofore have been diverted and appropriately used in the two states." *Id.* at 395-96. Historically, based upon the 1908-43 period, the ratio of diversions between the ditches in Water District 67 in Colorado (below John Martin) and those in Kansas was about 65/35.[40] Patterson, however, suggested that the future apportionment should be 60/40 in order to compensate Kansas for the increased use by ditches above John Martin. *Id.* at 420.

By the tenth meeting of the commission in September, 1947, the engineering committee had completed and submitted its report on basic water supply and use data, and the specific allocations in Article V began to emerge. The format of the apportionment was based upon the interim operating agreement negotiated by Mendenhall and Leavitt. Article V was essentially final by the fourteenth meeting in July, 1948, including an agreement that Kansas' share of normal streamflows would be measured at the Stateline rather than as inflow to the Reservoir, and that Stateline flows could be made up of return flows and other accretions to the stream occurring below John Martin.

Put succinctly, the final form of Article V provides that all winter flows into John Martin Reservoir (November 1 to March 31) will be stored, subject to Colorado's right to demand releases of 100 cfs. Summer flows (April

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[40] An average of 159,100 acre-feet annually in Water District 67 compared to 84,400 acre-feet in Kansas. *Id* at 420.

1 to October 31) are to be passed through the Reservoir up to flows of 750 cfs. The apportionment of these flows gives Colorado the right to releases from John Martin equivalent to river flow up to 500 cfs, and Kansas the right to that portion of river flow between 500 and 750 cfs. Summer inflow in excess of these releases is stored.

Stored water, whether conserved during the winter or summer months, is a common resource. Either state may demand releases of stored water "at any time during the summer storage period," provided that releases to Colorado shall not exceed the rate of 750 cfs and those to Kansas may not be greater than 500 cfs. If the conservation pool is less than 20,000 acre-feet, the release rates drop to 600 and 400 cfs, respectively. When there is water in the conservation pool, users upstream of John Martin are free from senior priorities in Water District 67. However, if the conservation pool is liable to be exhausted within fourteen days, Colorado must revert to administration of decreed priorities. Under those circumstances, Kansas is not entitled to any of the flows entering John Martin, although waters which may flow across the Stateline are apportioned to Kansas. Ditch rights within Water District 67 and in Kansas may not be increased unless the compact administration finds that usable flows will not be materially depleted or adversely affected.

During the hearings on legislation to secure congressional consent to the compact, it was pointed out that the division of water was basically on a 60-40 ratio. Jt. Exh. 15 at 11, 15, 33. However, this was not intended as a rigid formula. Gail L. Ireland testified that either state might take more of the stored water "if the needs and conditions require it." *Id.* at 15. He said that the provisions

allowing both states to draw upon the pool of conserved water were inserted deliberately "in order to provide the water users with the very best possible use of this water at all times." *Id.* Hans Kramer described Article V as a "self-imposed rationing system." *Id.* at 33. General Kramer also pointed out that the compact precluded the allowance or accumulation of credits or debits due to variations from the 60-40 ratio, a provision which he called "boldly progressive." *Id.* All witnesses, for both states, expressed the same optimism that a half century of almost constant litigation was now fairly and finally settled. Clifford H. Stone, Director of the Colorado Water Conservation Board, called it a "red-letter day." *Id.* at 7.

Of course, since 1980 deliveries to Kansas and to the Colorado users in Water District 67 have been made pursuant to the 1980 Operating Plan rather than the provisions of Article V. The 1980 plan supersedes the "common pool" concept in John Martin Reservoir and establishes separate storage accounts for each state. Kansas takes the legal position that the compact administration lacked authority to adopt the 1980 plan. Yet Kansas acknowledges the benefits to both states that accrue from operating under the plan; Kansas has not exercised its option to cancel it; and Kansas makes no claim against the compact administration for the way in which it has administered the compact. Kan. Answer Br. at 52-53; RT Vol. 78 at 13.

In its Closing Brief re Kansas' Well Claim, Colorado quotes the testimony to Congress by George S. Knapp, the Kansas Chief Engineer and Chairman of the Kansas commissioners, to the effect that all the compact did was to convert floodwaters that otherwise would have gone to

waste into usable flows. Page 4. But that is not Knapp's full view of the compact. Indeed, in his report, also made part of the congressional hearing record, he specifically stated that the compact divided the "ordinary river flow" in addition to floodwaters made usable through the construction of John Martin Reservoir. Jt. Exh. 15 at 19.

Colorado states that the compact does not apportion the river on the basis of beneficial consumptive use, but rather "provides for a flexible and indeterminate apportionment based on the right of both States to make demands for releases from John Martin Reservoir." Colo. Closing Well Br. at 4. Of course, the compact also protects *inflow* into John Martin and divides, between the two states, the normal summer flow of the river, which must be passed through the Reservoir. Colorado's description of a "flexible and indeterminate apportionment" appears to come from a 1951 letter written by Hans Kramer to the Corps of Engineers. Colo. Exh. 57 at 2. In that letter Kramer describes the flexible philosophy as "Live and Let Live," which is also quoted by Colorado. Colo. Closing Well Br. at 5. However, it is clear that Kramer's remarks relate only to the conservation pool in John Martin and the ability of both states to draw upon it according to need.[41] Kramer's letter was not an effort to describe or summarize the entire compact.

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[41] The Arkansas River Compact contrasts sharply with the Pecos River Compact adopted by New Mexico and Texas at about the same time, namely, in 1948. The Pecos River Compact was based upon an Inflow-Outflow Manual which was to be used in determining flows into Texas according to particular levels of precipitation, and under consumption conditions prevailing in New Mexico in 1947. Despite this specificity, litigation developed when it became clear that the tables in the manual did not describe the actual state of the river, and that Texas was not receiving the flows originally intended. *Texas v. New Mexico,*

F. Conclusions about the Meaning of the Compact.

From all of the evidence in the case, and not merely from the summary and citations in this section of the Report, I have reached these conclusions about the meaning of the Arkansas River Compact:

1. The compact commissioners intended to and did effect an equitable apportionment of the waters of the Arkansas River.

2. The apportionment in the compact includes the normal flows of the river, as well as a division of the benefits associated with the conservation pool in John Martin Reservoir. Kansas is not limited merely to receiving its share of floodwaters conserved by John Martin Reservoir and which otherwise would have been unusable.

3. The apportionment was based upon conditions that existed at the time of the compact negotiations. The allocation of normal flows reflected generally the existing division of waters between the states and the uses that had been occurring. There was no intent to deprive existing users of water; and except as might be possible through increases in the usable supply, there was no intent to provide water for new irrigation.

4. The compact was intended to and does apply to all waters originating in the natural drainage basin of the Arkansas River and its tributaries upstream from the Stateline. This includes return flows from the use of such

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462 U.S. 554, 77 L.Ed.2d 1, 103 S.Ct. 2558 (1983); *Texas v. New Mexico*, 482 U.S. 124, 96 L.Ed.2d 105, 107 S.Ct. 2279 (1987).

water, and to tributary groundwater. Specifically, the compact applies to groundwater in the valley fill aquifer and in the bench or surficial aquifer, as described in the evidence.

5. Article IV-D allows future development of the Arkansas River basin in both Colorado and Kansas, provided that such development or construction does not materially deplete the usable flows of the river for use in either or both states. The compact is intended to protect such usable flows from material depletion caused by any increased consumptive use, including the construction of new wells or increased levels of pumping from precompact wells.

6. The term "materially depleted" in Article IV-D was meant to preclude complaints for trivial or inconsequential reductions in flow.

Additional conclusions about the intent of the compact are included later in the Report as part of the discussion of specific issues.

SECTION XI

COLORADO'S ADMINISTRATION OF GROUNDWATER PUMPING

Prior to 1965 Colorado had no administrative system for the regulation of groundwater pumping. Wells could be constructed and operated without regard to their impact on surface water users. Both the state engineer and the Attorney General of Colorado took the view that the state engineer did not have authority to curtail well production. Colo. Exhs. 365, 367, 368. The only exception, advised the Attorney General in 1964, was for wells "in the stream bed itself." Colo. Exh. 368. This remained his opinion, even though he stated that "We are all aware that tributary underground waters are a part of the natural streams of the watersheds in which they are situated, and are subject to the doctrine of appropriation under our State Constitution." Colo. Exh. 368.

The Colorado Supreme Court in *Fellhauer v. People*, 167 Colo. 320, 328-9, 447 P.2d 986, 990 (1968), quoted Benjamin Stapleton, Chairman of the Colorado Water Conservation Board, for a contrary view of the authority of the state engineer to regulate groundwater, but found it unnecessary to resolve the question. In any event, Colorado made no effort to regulate the pumping of groundwater tributary to the Arkansas River before 1965.

In 1957 Colorado had adopted legislation requiring permits for new wells, and calling for the registration of existing wells. The issuance of the permit, however, was ministerial. The state engineer could not withhold a well permit. RT Vol. 76 at 25, 106. The 1957 statute provided that:

> "Upon receipt of an application for a new, increased or additional supply of ground water from an area outside the boundaries of a tentatively critical ground water district . . . the State Engineer shall issue a 'permit to use ground water.' " Colo. Sess. Laws Ch. 289, § 5 (1957).

The Colorado system of laws and administration thus permitted a large number of wells to be drilled in the alluvium of the Arkansas River basin without consideration of their impact on vested surface rights, and indeed in the early years even without the knowledge of the state. According to evidence introduced by Colorado, some 1233 new large irrigation wells (i.e., those having a capacity of 100 or more gallons per minute) were drilled between 1949 and 1965. Colo. Exh. 165*, Table A.1. The Colorado evidence also shows 112 such wells allowed after 1965. Kansas inventoried wells over 50 gpm, and noted even a larger number of postcompact wells.[42]

A. Comparison Between Surface and Groundwater Control.

The lack of control over wells is in sharp contrast to Colorado's tightly administered system for the regulation of surface diversions. Colorado is an "appropriation" state. Article XVI, section 6 of the Colorado constitution provides, *inter alia*:

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[42] Kansas' evidence showed a total of 2,543 wells in 1985, and in the order of 850 in 1948. Colo. Exh. 851; Kan. Exh. 30, Table 2.

> "The right to divert the unappropriated waters of any natural stream to beneficial uses shall never be denied. Priority of appropriation shall give the better right as between those using the water for the same purpose."

As to surface diversions, Colorado thus follows the principle of "first in time, first in right." Indeed, that was the rule even before the state constitution was adopted. *Coffin v. Left Hand Ditch Co.*, 6 Colo. 443 (1882). Large-scale irrigation along the Arkansas River began in 1974 in the Rocky Ford area. Jt. Exh. 105 at 8. One of the senior rights to divert surface flows from the Arkansas River belongs to the Rocky Ford Ditch for 111.76 cfs, with a priority date of May 15, 1874. Kan. Exh. 19, 20.

The state is now divided into seven water divisions, corresponding to major surface drainage areas. Division 2 covers the Arkansas River, and that division in turn includes three water districts that embrace the mainstem of the river between Pueblo and the Stateline. Districts 14 and 17 lie upstream of John Martin, and District 67 covers the area from John Martin to the Stateline. Each water district is administered by a water commissioner who is an employee of the Division of Water Resources. These commissioners regulate the surface flow of the river in accord with the various rights and decrees.

In times of shortage, canals with junior water rights are curtailed in order to satisfy the demands of more senior rights. Because the river is over-appropriated, there is frequently a "call" on the river, that is, a limitation on diversions under junior rights in order to make water available to a canal with prior rights. RT Vol. 72 at 99-100. The call may move up and down the river "on an

hourly basis." RT Vol. 78 at 56. In 1984, the state engineer issued a water rights tabulation showing approximately 7,000 separate water rights along the Arkansas River, each with its own priority. Jt. Exh. 25.

River flows and diversions are now regulated through an extremely sophisticated satellite monitoring system. Most of the surface water gages have a continuous monitoring device associated with them, and streamflows from the various locations are relayed from the gaging stations to Denver by satellite. RT Vol. 67 at 117-18. There are some 80 data collection platforms in the Arkansas River basin, monitoring flows on the mainstem, on the tributaries, and at the major canals. *Id.* at 118. Data are collected at fifteen minute intervals, and are automatically relayed every four hours. However, Colorado officials can "dial in" and get data "as little as 15 minutes old." *Id.* at 120.

By way of contrast, Colorado does not generally require meters on wells, does not require any reports on the amount of water pumped, and does not have well pumping data along the Arkansas, except as prepared in connection with this case or for USGS or other reports. Indeed, one of the major factual issues during this trial has been the amount of water pumped, both in precompact and postcompact years. The location and distribution of pumping are also important for hydrologic modeling purposes. Both states have made enormous efforts under difficult and sometimes virtually impossible circumstances to collect or to create the required pumping data. But even so, reproducing conditions since 1950

cannot be done with certainty. Obviously Colorado's well data base could stand improvement.[43]

B. The Increases in Groundwater Pumping.

Pumping from groundwater tributary to the Arkansas River was not significant in the precompact years. Dr. Jeris Danielson, who was then the state engineer and head of the Colorado Division of Water

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[43] Both the former and present state engineers testified that requiring meters on wells was not feasible. Dr. Jeris Danielson, who was then the state engineer, testified that requiring meters on some 1,600 wells spread over thousands of square miles does not mean that the state would get compliance or accurate records. "I have seen many instances where a meter never works on a well. It is always broken. It is vandalized. It has sand in the mechanism. It just will not work." RT Vol. 77 at 126. Dr. Danielson said, "I can't lock up 1,600 well owners in the Pueblo County jail because they refuse to have a meter that works. So you have to look at another way to skin the cat." RT Vol. 77 at 127. His policy was to require meters on replacement well permits. He concluded that "Ultimately, we'll have a meter on every well." RT Vol. 77 at 128. Hal Simpson, the current state engineer, testified earlier in his capacity as deputy state engineer. He emphasized the physical difficulty of maintaining flow meters in older wells. He said they pump sand and "wear out very fast." RT Vol. 67 at 116. For this trial, both states estimated pumping through the use of power records and pump efficiency tests. However, none of these data sources, particularly during the earlier years, was what engineers would like to have. For the future, it would seem that at least the factual basis required to estimate pumping through this methodology could be strengthened. Hal Simpson testified that he is now requiring the two major well organizations in the Arkansas Valley to measure power consumption coefficients and estimate pumping based on power records. RT Vol. 130 at 52-53.

Resources, testified that wells "weren't relied upon generally." RT Vol. 76 at 35. Although Colorado had no records during the 1940s of the number of wells or amounts of water pumped, later studies attempted to create these data. A 1968 report prepared pursuant to Colorado Senate Bill 407 put the pumping in 1940 at only 2,300 acre-feet. Jt. Exh. 92 at 22.[44] The report shows a gradual increase in pumping during the 1940s, reaching 23,000 acre-feet in 1949. *Id.* at 22. Similar figures were published by the Colorado state engineer in a 1975 report prepared for the trial on the amendment to the 1973 Rules in the case of *Kuiper v. Atchison, Topeka & Santa Fe Ry. Co.*, 195 Colo. 557, 581 P.2d 293 (1978). Jt. Exh. 94 at 22; RT Vol. 77 at 35-36. By way of contrast, diversions by the various ditch companies between Pueblo and the Stateline averaged approximately 857,000 acre-feet annually during the precompact years of 1908-1942. Jt. Exh. 5 at 20.

The "big surge" in well development along the Arkansas River came in the 1950s and early 1960s. RT Vol. 76 at 102. Danielson attributed this rapid increase to an improvement in technology, namely, the vertical turbine pump, and to the availability of inexpensive electrical power. RT Vol. 76 at 102; Kan. Exh. 514, Vol. I at 210. Precompact pumping had been accomplished primarily by centrifugal lift pumps, sometimes powered by tractors. RT Vol. 76 at 102. The Water Court in the trial on the

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[44] The Colorado evidence prepared for this trial claimed that the 1940 pumping amounted to 36,837 acre-feet. The approach used by Colorado to reach this larger figure will be discussed later.

state engineer's amendment to his 1973 Rules described the use and value of groundwater in one of its findings:

> "The evidence is uncontroverted that irrigation wells are now used where available to overlying owners to supplement surface decrees when surface supplies are short. Thus, wells are pumped in the spring before the runoff begins in order to start crops. Without supplemental groundwater in the spring, seed loss may be experienced from lack of soil moisture necessary for germination. Wells are also pumped in the late summer and fall when surface water supplies are not adequate to 'finish' crops and lack of well water at this time reduces crop yields. Such a regimen of conjunctive use of well and River water has developed uniformly throughout the Arkansas Basin over a substantial time period, and now appears to have the acquiescence if not the support of a substantial part of the irrigation economy in the basin . . . The use of wells in the Arkansas Valley has made water available in the early spring and late summer and fall periods when water is needed for irrigation but would not otherwise be available from surface diversions." Jt. Exh. 157 at 10.

While pumping data are in dispute, both states showed large increases in pumping between 1950, the first postcompact year, and 1964, the last year before efforts by Colorado to regulate pumping. Colorado estimated pumping in 1950 from Pueblo to the Stateline at 41,458 acre-feet. In 1964 Colorado shows that pumping had risen to 203,925 acre-feet. Colo. Exh. 165*, Table A.1. The comparable Kansas figures are 31,201 acre-feet for 1950, and 220,079 acre-feet for 1964. Colo. Exh. 852.

The consumptive use of well water through transpiration and evaporation varies with many factors – the type of crop, the location, method of irrigation, water application rate, and various climate and soil conditions. Along the Arkansas River in Colorado, average consumptive use figures ranging between 60% and 80% have been used in various historic documents. Colo. Exh. 386 at 275; Jt. Exh. 92 at ii. Most of the reports, however, fall between 70% and 80%. Jt. Exh. 78; Jt. Exh. 91 at 11. The State of Colorado itself, in a report done in 1975, estimated consumptive use at 75%, with the remainder of the applied water returning to the stream system. Jt. Exh. 94 at 51.

Whatever the specific percentage may be, however, it is clear that additional pumping in Colorado, absent an offset in surface diversions, increases the consumptive use of water in Colorado and ultimately decreases the surface flows of the Arkansas River.

Danielson testified that the damage done to surface flows "is very closely related to the consumptive use of the well water that is withdrawn from the alluvium." RT Vol. 77 at 34, 37-38. In the 1975 trial of *Kuiper v. Atchison, Topeka & Santa Fe Ry. Co.*, on the Amendment to the 1973 Rules, Danielson who was then the deputy state engineer testified to the same effect, namely, that the consumptive use of well water can be shown as a decrease in river flows. In that case, he estimated that such consumptive use averaged about 112,800 acre-feet per year in the period 1965 through 1972, plus phreatophyte losses. Kan. Exh. 514, Vol. I at 232. See also Jt. Exh. 92 at ii, vi: Jt. Exh. 94 at 1, 53. However, under examination by Colorado's counsel during this trial, he said that the river loss which he quantified occurred in the whole reach from Pueblo to

the Stateline. It would not in his opinion translate into a reduction at the Stateline. He did not make a Stateline determination. RT Vol. 78 at 85.

C. Colorado's First Efforts to Regulate Pumping.

The pressure to regulate groundwater pumping in Colorado, which resulted in the 1965 legislation, came not from Kansas but from holders of surface rights in Colorado. One commentator states that matters came to a head when a number of the canal companies in the Arkansas Valley filed a petition with the state engineer demanding that he curtail well diversions, and their petition was dismissed for lack of jurisdiction.[45] However, another commentator indicates that it was a "crisis" situation in the state as a whole. He states that in 1964 alone some 5,911 new wells were constructed.[46] In any event, the 1965 Act succinctly directed the state engineer to administer the distribution of surface waters, "including the underground waters tributary thereto" in accordance with the right of priority of appropriation. Colo. Exh. 378, C.R.S. § 148-11-22. The state engineer was also authorized to apply to the courts for an injunction to prevent well diversions "from materially injuring the vested rights of other appropriators." *Id.*

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[45] "Integrating Ground and Surface Water Use in an Appropriation State," 20 Rocky Mountain Min. L. Inst. 691 at 697 (1975).

[46] "Appropriation and Colorado's Ground Water: a Continuing Dilemma?" 40 Univ. Colo. Law Rev. 133 (1967), also quoted in "A Survey of Colorado Water Law," 47 Denver Law Journal 226 at 324 (1970).

The state engineer's first attempt to enforce this legislation was set aside by the Colorado Supreme Court. The division engineer ordered that 39 wells along the Arkansas River cease pumping, although he testified that all of the large irrigation wells, more than 1,600 of them, affected river flows. *Fellhauer v. People*, 167 Colo. 320, 447 P.2d 986 at 992-93 (1968). The division engineer added that he didn't want to shut down all of the wells, "because you are going to affect the economy of the valley." *Id.* Under these circumstances, the Colorado Supreme Court, sitting *en banc*, easily found that the action of the state engineer's office was discriminatory, and in violation of the equal protection clause of the federal constitution and the due process clause of the Colorado constitution. *Id.* at 993.

However, going far beyond what was required to decide the case before it, the Supreme Court set forth three "requirements" for any future valid regulation of wells under the 1965 Act. Pertinent here is the statement that there must be only a "reasonable lessening" of material injury to senior rights. *Id.* at 993. This appears to be a more lenient standard than the act itself, which calls for an injunction when necessary "to prevent" material injury. The "reasonable lessening" test is tied to another pronouncement of the Court. The Court stated that, along with the protection of vested rights, "there shall be *maximum utilization* of the water of this state." *Id.* at 994, emphasis in original. The "new drama" of the next century, said the Court, would be how the doctrine of maximum utilization could be constitutionally integrated into the law of vested rights. *Id.* at 994.

Notwithstanding the Court's rebuff of his efforts to regulate pumping from existing wells, the state engineer essentially refused after 1965 to issue permits for new alluvial wells along the Arkansas River between Pueblo and John Martin Reservoir. RT Vol. 130 at 115-16. This portion of the river was described by Colorado throughout the trial as Reach 3. However, the state engineer did not follow the same policy in the river reach between John Martin and the Stateline, a distance of about 58 miles. Colorado designated this area as Reach 4, and its tabulation of wells shows that 90 new wells were allowed in Reach 4 between 1965 and 1985. Colo. Exh. 165*, Table A.1. Danielson testified that as state engineer he did not issue any well permits after 1979, either upstream or downstream of John Martin, because there was "no unappropriated ground water left." RT Vol. 76 at 115, 110.

D. The 1967-68 Studies.

In 1967 the Colorado General Assembly adopted Senate Bill 407, "providing for a study of water resources, water uses, and the administration of applicable water laws." Colo. Exh. 380. The legislative charge was to investigate relationships in the areas where intermingled surface and groundwater were commonly used in conjunction with each other, and to determine the need for and content of legislation that would provide for the integrated administration of all diversions and uses of water. The directions further called for the protection of all vested rights, along with the "full utilization of all waters in the state." *Id.*, Section 1(b). The study of the Arkansas River that resulted from that legislation was the basis of a 1968 report prepared by W. W. Wheeler and

Associates, and Woodward-Clyde & Associates, hereafter referred to as the "Wheeler Report." Jt. Exh. 92.

The Wheeler Report states that drafts were reviewed by the Colorado state engineer, the Colorado Water Conservation Board, and the U. S. Geological Survey. The report concludes, *inter alia*:

> (a) That the limited and variable flows of the Arkansas River are generally inadequate to fully supply the irrigation water requirements of the basin.
>
> (b) *That the use of wells in recent years has materially decreased the surface flows available to direct flow and storage rights.* (Emphasis added)
>
> (c) That groundwater in the alluvium between Pueblo and the Stateline amounts to about 1,600,000 acre-feet, of which about 460,000 acre-feet are theoretically useable. Jt. Exh. 92 at v and vi.

The report also recommended that recorders be installed on all wells, and that accurate and continuous discharge records be obtained of major tributary inflow. *Id.* at vii. Neither of these recommendations was implemented, although some tributary streamflow gages were installed.

E. The 1969 Act.

The next legislative effort attempting to reconcile the competition between wells and surface rights was the "Water Right Determination and Administration Act of

1969." Colo. Exh. 385; C.R.S. § 148-21-1, *et seq.*[47] This act made significant changes in Colorado water law, establishing the seven new water divisions, setting up a system of Water Courts, requiring a statewide tabulation of water rights, and initiating numerous other administrative procedures. For purposes of this action, however, the importance of the act lies in its declaration of policy and in its provisions relating to wells.

The legislature declared it to be the state policy of Colorado ". . . to integrate the appropriation, use and administration of underground water tributary to a stream with the use of surface water, in such a way as to maximize the beneficial use of all of the waters of this state." § 148-21-2(1). The act further declared ". . . that the use of underground waters as an independent source or in conjunction with surface waters is necessary to the present and future welfare of the people of this state." § 148-21-2(2). The legislature directed that "the existing use of groundwater, either independently or in conjunction with surface rights, shall be recognized to the fullest extent possible, subject to the preservation of other existing vested rights." § 148-21-2(2)(b). The act provided that groundwater could also be considered as an alternate or supplemental source of supply for surface decrees previously entered.

Groundwater rights were brought into the adjudication system. Applications for groundwater rights filed by July 1, 1971 were permitted to obtain a priority date

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[47] "Few proposals have undergone such extensive and heated debate as the 1969 water bills." The Groundwater-Surface Water Conflict, 43 Univ. of Colo. Law Rev. 1, 24 (1971).

corresponding to the date of actual appropriation. § 148-21-22. State water officials were directed to administer ground and surface waters together in accordance with their priorities, but diversions were not to be curtailed unless they would cause "material injury" to water rights with senior priorities. § 148-21-35.

The references to conjunctive use and maximizing the use of all of the waters in the state coincide with the conclusions of the 1968 Wheeler Report. That report pointed to 1.6 million acre-feet of groundwater in the alluvium between Pueblo and the Stateline, of which 460,000 acre-feet were said to be "theoretically useable."[48] Jt. Exh. 92 at vi. The report concluded that "The best utilization of the basin's water resources would be through the integrated or conjunctive use of wells, the storage of winter flows and excessive diversions, and the delivery of water in phase with crop requirements." *Id.*

Obviously, the policies and directions enunciated by this act did little to resolve the inherent conflicts between a priority system for surface diversions that had been fully developed before the turn of the century, and the much later use of wells pumping tributary groundwater. The dilemma was softened, perhaps, only by the fact that well owners and surface rights holders were not distinct groups pitted against each other. Most owners of surface

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[48] The Colorado Supreme Court later used an estimate of 2.0 million acre-feet of groundwater in the alluvium. *Kuiper v. Atchison, Topeka & Santa Fe Ry. Co.*, 195 Colo. 557, 581 P.2d 293 (1978). The USGS also used 2.0 million acre-feet in a 1970 report. Jt. Exh. 66 at 2.

rights also benefitted from wells. *Kuiper v. Atchison, Topeka & Santa Fe Ry. Co.*, 195 Colo. 557, 581 P.2d 293 (1978).

F. The 1971 Kuiper Decision.

Meanwhile, the state engineer was proceeding to develop rules and regulations as required by the *Fellhauer* decision. The regulations, as promulgated, were applicable to the South Platte and Arkansas Rivers for only the limited period of August 8 to October 15, 1969. Colo. Exh. 383. They reflected the requirement in *Fellhauer*, that the regulations effect a "reasonable lessening" of material injury, rather than the prevention of such injury. The policies under which the rules were promulgated included the statement:

> "Every effort is made to utilize the water found in the alluvium which water is hydraulically connected to the surface channel of the streams of the state." *Id.* at 2.

Moreover, the policies declared that the existing use of groundwater, either independently or in conjunction with surface rights, "shall be recognized to the fullest extent possible, subject to the preservation of other existing vested rights." *Id.*

The regulations were designed, they stated, to accomplish three main purposes: to protect vested rights, to preserve the economy that had been established through the use of wells "to the fullest extent possible," and to obtain maximum possible utilization of the waters of the state. *Id.*

The regulations grouped wells into three zones according to the time that would elapse between the commencement of pumping and their effect upon the surface stream. The regulations were to be implemented only upon the written demand of a senior surface appropriator and, in no event were wells to be curtailed more than three days per week. *Id.* at 6.

A group of well owners in the South Platte Basin promptly attacked the regulations and were able to obtain a permanent injunction from the trial court. On appeal, the Colorado Supreme Court, sitting *en banc*, overturned the trial court, rejecting the various objections to the regulations, finding that they were consistent with the requirements of the *Fellhauer* decision and of the 1969 Act, and that they represented a reasonable attempt to achieve the goal of maximum utilization. *Kuiper v. Well Owners Conservation Ass'n*, 176 Colo. 119, 490 P.2d 268 (1971).

In this decision, the Colorado Supreme Court reinforced its earlier policy pronouncements:

> "In *Fellhauer*, we attempted to sound the note of a new era in the utilization and optimal use of water. It appears to us that the General Assembly reacted favorably to that attempt and in turn sought to promote in detail the general thought of *Fellhauer*. We have the same view of the acts of the State Engineer. We suggest that there is a slight indication of a feeling upon the part of the plaintiffs and on the part of the trial court that changes should not be required in the operation of wells on the Platte River. There must be

change, and courts, legislators, the State Engineer and users must recognize it." 490 P.2d 268 at 283 (1971); Colo. Exh. 386.

G. The 1973 Rules.

Continuing to wrestle with the competing concepts of maximizing the use of ground and surface rights while still protecting the priority system, the state engineer issued new rules and regulations in 1972. RT Vol. 76 at 110-11; Jt. Exh. 93. These rules became effective on February 19, 1973, and today are still the rules and regulations which regulate pumping on the Arkansas River. RT Vol. 76 at 19-20; Jt. Exh. 157 at 5-6. They are quite simple. They limit pumping to three days a week, unless the division engineer approves a written plan whereby "the amount of the depletion from the stream by said well or wells will be returned to the stream so that prior vested rights are not damaged." Jt. Exh. 93 at 2. The rules are intended to provide for a "reasonable lessening of material injury, whether present or future, to senior appropriators." *Id.* No protests to these rules were filed. Jt. Exh. 157 at 6.

Dr. Danielson, then state engineer for the State of Colorado, was called by Kansas as a hostile witness during the trial of this case. He acknowledged that the 1973 rules and regulations have not, in fact, reduced pumping below the 1973 levels. Indeed, pumping increased. RT Vol. 76 at 30-31. According to Colorado's own pumping data, well pumping in 1973 amounted to 128,354 acre-feet. Yet pumping in the highest subsequent year, 1976, reached 285,887 acre-feet. In no year through 1985 was the pumping less than the 1973 level. Colo. Exh. 165*, Table A.1.

While Danielson testified that the 1973 rules were intended to "protect existing wells, not to allow expansion," the state engineer at that time (C. J. Kuiper) continued to permit new wells in the area downstream from John Martin. RT Vol. 77 at 118; RT Vol. 76 at 112-15; RT Vol. 130 at 63-64. This was particularly true in the area below the Buffalo Canal headgate, that is, downstream from the last surface diversion in Colorado, and close to the Stateline. In its closing brief, Colorado states that it "does not dispute that wells drilled east of the Buffalo Canal headgate after 1965 depleted Stateline flows to some extent during the 1970s." Colo. Closing Well Br. at 19; RT Vol. 115 at 62. However, Colorado maintains that such depletions have been offset by the 1980 Operating Plan for John Martin Reservoir.

H. Amendment to 1973 Rules.

On January 4, 1974 the state engineer attempted to tighten the 1973 regulations. He proposed an Amended Rule 3 to be effective March 27, 1974. The amendment provided for pumping curtailment of five days per week during 1974, six days during 1975, and total curtailment in 1976. *Kuiper v. Atchison, Topeka & Santa Fe Ry. Co.*, 195 Colo. 557, 581 P.2d 293 (1978); Colo. Exh. 387. The shutdown provisions, however, under both the amendment and the 1973 rules, did not apply to wells operated as alternate points of diversion for surface rights in priority, or wells that were embraced within augmentation plans approved by the state engineer. *Id.* at 296.

Numerous protests were filed to the amended rule. These were consolidated for trial in the Water Court,

which disapproved Amended Rule 3, but decreed that the 1973 rules should otherwise remain in effect, thus allowing all wells to continue to pump at least three days a week. The state engineer appealed. The Colorado Supreme Court, sitting *en banc*, affirmed the position of the Water Court. *Id.* at 294.

I. State Engineer's 1975 Report.

In preparation for the Water Court trial on the amendment to the 1973 rules, the Colorado state engineer prepared a report entitled "Stream Depletion by Wells in the Arkansas River Basin – Colorado, March, 1975." Jt. Exh. 94; RT Vol. 76 at 86-87. The study and report were done under the supervision of Dr. Danielson, who was then the deputy state engineer.[49] Dr. Danielson testified that he was personally involved in this work, and the report became a principal exhibit in the trial before the Water Court. RT Vol. 76 at 88, 94; RT Vol. 77 at 35-36.

This 1975 report is significant here also. The state engineer's investigation was undertaken:

> ". . . for the purpose of determining if the pumping of alluvial wells is significantly depleting the Arkansas River and thus causing material injury to senior surface water appropriators.

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[49] Dr. Danielson joined the state engineer's office in 1970 as chief of planning and was appointed state engineer in 1979. Colorado characterized him as a "highly qualified expert in his own right, with a doctorate in civil engineering from Colorado State University, with emphasis in water resources, fluid dynamics, and hydrology." Colo. Closing Well Br. at 151. His full qualifications are found in Kansas Exhibit 634.

> More specifically, the objective of this report is to quantitatively evaluate the effects of wells on stream flows, diversions, and river gain (or loss) in the reach of the Arkansas River between Canon City and the State line." Jt. Exh. 94 at 2.

The report concluded:

> "The rapid growth of high-capacity irrigation wells tapping the alluvial aquifer of the Arkansas River Valley in southeastern Colorado during the late 1940's, 1950's and early 1960's has decreased the amount of river water available for surface water appropriators." Jt. Exh. 94 at 1.

Danielson testified at the trial that he still agreed with that statement. RT Vol. 76 at 88.

The report also states, "The increasing use of ground water for irrigation in the Arkansas River basin since 1950 has affected stream flows in such a way as to deprive senior water users of a portion of their lawful water supply." Jt. Exh. 94 at 53. According to the report, "excessive pumping" from the Arkansas River alluvium has caused a "decrease in stream flows below Canon City." *Id.* at 53. Danielson testified during the trial here that he still agreed also with that conclusion. RT Vol. 78 at 85.

For the period 1965-72, the report states that the reduction in return flows between Canon City and the Stateline, and the decrease in diversions, averaged 112,800 acre-feet per year, which was "equivalent to the consumptive use of well water" and phreatophytic losses.

Jt. Exh. 94 at 53. Considering the data now available, Danielson testified that the 112,800 acre-foot figure might be a "bit high," but "does not appear outlandish." RT Vol. 78 at 87. However, he cautioned that it does not translate directly into Stateline depletions. That report did not consider possible offsets to the impact of groundwater pumping on Stateline flows, such as transmountain return flows, or forced reductions in surface diversions in Colorado that might cushion the impact at the Stateline.

The importance of this report is underscored by a 1987 letter from Myron B. Fiering, one of Colorado's most distinguished experts, written to another member of the Colorado trial team.[50] Dr. Fiering wrote:

> "The 1975 Danielson Report – *the one we all wish had never been written* – has a basin model whose complexity is, in my view, just about right. . . . The only problem I have with the Danielson Report is that *its unhappy conclusion might be unassailable* without a more detailed model – and a more detailed model implies more parameters and more equations, all of which render the results more subject to error . . . a real Hobson's choice!" Kan. Exh. 674 at 3. (Emphasis added).

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[50] Dr. Fiering, now deceased, was one of the most distinguished scientists in America. At the time of his testimony he was the Gordon McKay Professor of Engineering and Applied Mathematics at Harvard University, having been a member of the Harvard faculty since 1961. RT Vol. 109 at 99. His exceptional curriculum vitae is found in Colorado Exhibit 665. Dr. Fiering was one of the experts assembled by Colorado to advise the state in the development of its water budget analysis.

J. The Colorado Supreme Court Decision on Amended Rule 3.

In its opinion on the Amended Rule 3, the Colorado Supreme Court noted evidence before the Water Court that well pumping in 1972 exceeded 200,000 acre-feet; and that an estimated 2 million acre-feet of water is generally held in transient storage within the river alluvium. *Kuiper v. Atchison, Topeka & Santa Fe Ry. Co.*, 195 Colo. 557, 581 P.2d 293 (1978). The Court pointed out, however, that a restriction of well pumping does not necessarily result in a comparable increase in the supply of surface water. The Court cited many factors that can offset or modify the depletive use of well water: changes in groundwater storage; reduction in phreatophytic losses resulting from lowering the groundwater table; increased irrigation efficiencies; and variations in the amount of river flow. But in the final analysis the Supreme Court struck down the amendment because it did not rest upon real operating experience and an evaluation of operations under the 1973 rules. 581 P.2d at 297.

The Water Court had found that there was no evidence that the amendment "was required to prevent material injury to vested senior rights at the time of a senior need." *Id.* at 296. The Supreme Court approved this ruling. It also characterized the amendment as a "drastic change," that under the circumstances was in conflict with legislative policy that:

> "Ground water diversions shall not be curtailed nor required to replace water withdrawn, for the benefit of surface right priorities, even though such surface right priorities be senior in priority date, when, assuming the absence of ground

> water withdrawal by junior priorities, water would not have been available for diversion by such surface right under the priority system." *Id.* at 296-97.

In short, the Supreme Court found that there was a duty upon the state engineer, before adopting the amendment, to determine that it would make additional water available for senior priorities, when needed. He did not do this, and could not do so, said the Court, because he did not yet know the effects of the 1973 rules. *Id.* at 297. Although the Court's decision was made in 1978, there has been no subsequent effort to amend the 1973 rules, which remain in effect today as the regulations for the control of groundwater pumping.

K. Policies Affecting the 1973 Rules.

Danielson and Simpson testified extensively about the policies that went into the formulation and administration of the 1973 rules.

> (a) To begin with, they understood that a strict administration of the priority system "would result in shut-off of nearly every well that existed in the state." RT Vol. 76 at 25-26. The state engineer's office did not believe that the legislature intended it to "go out and put them all out of business." RT Vol. 76 at 37, 34.
>
> (b) The state engineer's office also recognized the economic importance of preserving well pumping. Danielson testified that if the appropriation system were strictly implemented it would "bankrupt the eastern third of the state of Colorado." RT Vol. 76 at 39. The thrust of the state engineer was "not to go out and destroy

the economy." *Id.* at 26. "The idea was to save those wells, keep that economy alive." RT Vol. 77 at 64.

(c) Colorado faced a "very delicate balancing act," that is, to maximize use and still adhere to the priority system. *Id.* The approach chosen by the legislature, according to the state engineer, was "the maximum utilization concept, consistent with the priority system. RT Vol. 76 at 39. The state engineer saw the provisions of the 1969 Act regarding maximizing use as a "mandate." RT Vol. 77 at 35.

(d) Maximum use was sought through the use of groundwater and the alluvial groundwater storage capacity. *Id.* at 34-35. In turn, this meant employing the "reasonable lessening of injury" test for the protection of prior vested rights. RT Vol. 76 at 26, 29, 33. This is the test enunciated by the Supreme Court in the *Fellhauer* case, as opposed to the prevention of material injury. *Fellhauer,* 447 P.2d 986 at 993.

(e) The approach of curtailing pumping no more than four days a week had no "scientific basis," but rather was an "arbitrary approach" that was easily understood and administered. RT Vol. 76 at 28-29. However, at the time the state engineer believed that the four-sevenths curtailment provided a reasonable lessening of injury, and would give well owners an incentive to take advantage of the other aspects of the 1969 Act, namely, exchanges, substitute supply plans, and plans for augmentation. *Id.* at 26, 39.

In addition to the statutory and quasi-judicial duties that have been discussed, the state engineer since 1969

has been charged with the specific responsibility of making and enforcing such regulations as may be necessary to enable Colorado to meet its compact commitments. C.R.S. 1963, § 148-11-24, now C.R.S. § 37-80-104, 15 C.R.S. provides:

> "The state engineer shall make and enforce such regulations with respect to deliveries of water as will enable the state of Colorado to meet its compact commitments. In those cases where the compact is deficient in establishing standards for administration within Colorado to provide for meeting its terms, the state engineer shall make such regulations as will be legal and equitable to regulate distribution among the appropriators within Colorado obligated to curtail diversions to meet compact commitments, so as to restore lawful use conditions as they were before the effective date of the compact insofar as possible."

Dr. Danielson testified that the 1973 rules were not promulgated under this provision of the law. He said, "They are not intended to establish standards for administration within Colorado to meet terms of the Arkansas Compact, no. They are intended to govern the appropriation of groundwater in the Arkansas Valley." RT Vol. 76 at 85. Nor have rules to ensure compliance with the compact ever been prepared for the Arkansas River. He testified that it had not been done ". . . because it was never determined necessary to define an intrastate administrative scheme to meet that obligation." *Id.* at 86.

I have seen little in the extensive record of Colorado legislation, studies, reports, regulations and judicial decisions of this time affecting flows in the Arkansas River that appears to recognize Kansas' compact interest.

L. Augmentation Plans Under the 1973 Rules.

The 1969 Act provides for plans of augmentation, which were defined as follows:

> ". . . a detailed program to increase the supply of water available for beneficial use in a division or portion thereof by the development of new or alternate means or points of diversion, by a pooling of water resources, by water exchange projects, by providing substitute supplies of water, by the development of new sources of water or by any other appropriate means." Colo. Exh. 385 at 1202.

Based upon that legislative authority, the 1973 rules of the state engineer provide for an exemption from the four-sevenths curtailment. The rules require a written plan approved by the division engineer ". . . whereby the amount of the depletion from the stream by said well or wells will be returned to the stream so that prior vested rights are not damaged." Jt. Exh. 93 at 2. Under these circumstances, wells that are included in such an approved plan are exempt from any pumping curtailment. RT Vol. 77 at 110; Kan. Exh. 40, Doc. 59 at 2.

In Water District 67, which includes the area between John Martin Reservoir and the Stateline, the ditch companies organized a group known as the Lower Arkansas Water Management Association. RT Vol. 76 at 49. This

association, referred to generally as LAWMA, included on the order of 300 to 350 wells. *Id.* at 80.[51] The purpose of LAWMA was to develop a plan that would permit those wells to pump without restriction. RT Vol. 77 at 54.

Ultimately, with assistance from the state, the local association developed the Buffalo Canal Demonstration Project. Kan. Exh. 40, Docs. 15, 19, 24, 29, 49, 59. The project called for constructing eight wells along the Arkansas River, downstream from the headgate of the Buffalo Canal, having a capacity of not less than 25 cfs. *Id.* This water was then to be pumped into the Buffalo Canal and laterals to help offset depletions in the surface flows of the Arkansas River. RT Vol. 76 at 111-12; RT Vol. 77 at 110. These depletions were caused by "wells owned by Association members." Kan. Exh. 40, Doc. 59 at 1. Thus, the project did nothing more than use groundwater pumped from new wells downstream to help offset stream depletions caused by older wells upstream. RT Vol. 76 at 135; RT Vol. 16 at 77-78. Yet this project was approved by the state engineer as a "substitute supply" plan under the 1969 Act. RT Vol. 77 at 50-52.

The stated purpose of the project was to utilize "the unappropriated ground water below the Buffalo Canal headgate." Kan. Exh. 40, Doc. 59 at 1. It provided "much needed irrigation water" during the unusually dry period of 1974-78. *Id.* at 2. Moreover, association members were permitted "to pump unrestricted throughout the irrigation season." *Id.* According to the state engineer, the

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[51] Other testimony put the number of wells at about 400, or about 80% of the total downstream from John Martin Reservoir. RT Vol. 77 at 57.

benefits of this "management plan" were considerable "since so much of the economy is dependent upon irrigation water from alluvial wells." *Id.*

The eight demonstration project wells were located in the sixteen-mile reach between the last Colorado surface diversion and the Stateline. Only Kansas users could be affected by this pumping, but the impact on Stateline flows "was never a consideration." RT Vol. 77 at 83. The only constraints contemplated were those imposed by "economics and hydrogeology." Kan. Exh. 40, Doc. 11. Moreover, in this general area there were 50 to 60 post-1972 wells permitted by the state engineer. RT Vol. 76 at 127. Under the 1973 Rules, these wells would not have been allowed to pump even three days a week unless they were included in an augmentation plan. *Id.* at 126-127. Thus, LAWMA freed even these wells from restrictions if they were operated by members of that association.

Moreover, by substituting groundwater for surface flows, the Buffalo Canal, which holds a very senior right, freed up surface water for diversion by junior ditches upstream. RT Vol. 77 at 61. The LAWMA "augmentation" project thus added to the consumptive use of water in Colorado, but not to the common supply of the Arkansas River and its tributary groundwaters.

The eight demonstration project wells went into operation between 1975 and 1978, but ceased to operate in 1983. *Id.* at 102. In more recent times, LAWMA has begun to lease stored water in John Martin, and has purchased outright one small 6.5 cfs surface diversion right. *Id.* at 105-06. While this direction appears to be

more in line with the intent of the 1969 Act, no evidence was presented on the specific amounts of water involved.

In the area upstream from John Martin, another association has been formed, called Colorado Water Protective and Development Association. Like LAWMA, its purpose is to provide an augmentation plan that will protect its members from well curtailment. RT Vol. 78 at 25-26. Membership in this association is in the order of 700 to 800 members. RT Vol. 76 at 50; RT Vol. 78 at 45. This association has been making yearly arrangements with the division engineer to purchase limited amounts of "return flow" from transmountain imports. RT Vol. 78 at 26-29. However, the amounts appear small. Generally, they have been in the order of 10,000 acre-feet or less. RT Vol. 16 at 65.

A 1981 example shows that the members would need 18,764 acre-feet of groundwater to meet their full crop demands. RT Vol. 78 at 47. After various calculations, the report submitted to the division engineer concludes that the replacement requirement should be only 2,742 acre-feet. *Id.* at 48.

According to Colorado data, total pumping in Reach 3 in 1981 was approximately 133,000 acre-feet. Yet water provided for augmentation was only in the order of 7000 acre-feet. *Id.* at 61. Danielson acknowledged that 7000 acre-feet would not offset the streamflow depletions arising from some 133,000 acre-feet of pumping, but he pointed out that the 133,000 figure is a total for all wells in Reach 3, not merely those within the association. In any event, Danielson testified that there was not a "one

for one" replacement, but that he thought the replacement requirement was adequate under the rules and regulations. *Id.* at 53. He testified that the state engineer continually urges the association members "to be more sophisticated and to obtain more assets as they are able." *Id.* at 53.

The evidence showed that at least as late as 1983 the association had not developed and sought approval of a permanent plan of augmentation, although urged to do so by the division engineer. Kan. Exh. 41, Docs. 33, 35; RT Vol. 16 at 69. Rather, it operated on the basis of one-page annual letters simply listing the sources and sometimes the amounts of water to be obtained. In 1982, for example, it listed 1500 acre-feet of return flow from the Southeastern Water Conservancy District; 500 acre-feet of purchased transmountain water; the return flow from 5794.32 shares of Twin Lakes water; and the return flow from approximately 4000 acre-feet imported by the High Line Canal Co. Kan. Exh. 41, Doc. 25. The latter two sources did not indicate the amount of the actual return flow. Nor does it appear that the amount of the well depletions being addressed was ever calculated. RT Vol. 16 at 70-73; Kan. Exh. 41.

The division engineer sought more detail in the place, time, rate and amount of return to the Arkansas River for each of these sources, but the reply was as skimpy as the original data. Kan. Exh. 41, Docs. 26, 27. Some of these sources were also found later to be unacceptable by the division engineer because other users already held vested rights to the return flows. *Id.*, Docs. 34, 35. Nonetheless, it appears that these meager annual arrangements permitted all 700 or so members of the

association to pump without limit seven days a week. RT Vol. 16 at 73.

M. Conclusions.

Colorado allowed hundreds of wells to be constructed in the river alluvium without regard to their impact upon the surface flows of the Arkansas River, either in Colorado or in Kansas. Data on the number of wells and magnitude of their pumping were not generally known until the studies of the mid- to late 1960s. Yet postcompact pumping in Colorado clearly depletes the surface flows of the Arkansas River. While many of the studies showing such depletions covered the river from Pueblo *to* the Stateline, it is difficult to conceive that flows *across* the Stateline were not also depleted.

Colorado's efforts to regulate pumping were heavily tempered by its own economic considerations. The adopted concept of obtaining "maximum use" of the waters of the state through the pumping of groundwater ignored the downstream impact in Kansas and the rights of Kansas under the compact. Regulation under the 1973 Rules has not effectively reduced pumping, although perhaps pumping would have been even greater without such control. Nor does the evidence show that the augmentation plans have significantly offset the depletions from wells. Under appropriate circumstances, the conjunctive use of surface diversions and groundwater pumping can effectively increase available water supply, but any such effort cannot be focused solely on the benefits to Colorado users as though they are entitled to

consume the full supply. If a program of limited conjunctive use has any potential along the Arkansas (and there was no evidence on this matter during the liability phase of the trial), the program must also include Kansas' rights under the compact.

SECTION XII

DEPLETIONS OF STATELINE FLOW

The actual quantities of water in the Arkansas River flowing into Kansas are not in dispute. Stateline flows are gaged by the United Stages Geological Survey, and adjusted for diversions made by the Frontier Ditch just across the border in Colorado and delivered for use in Kansas. Stateline flows, as adjusted, for the period 1950-85 are set forth in the tables below. These amounts represent total annual flows, not usable flows. They include flood flows for years like 1965 when measured quantities reached 749,070 acre-feet, compared to a 1950-85 annual average of 144,051 acre-feet. The figures set forth below are for compact years, which run from November 1 to October 31.

The quantities of water in the left-hand column are those presented by Colorado.[52] Those in the right-hand column were tabulated by the United States, but based on Kansas data.[53] Kansas itself did not prepare a table of annual Stateline flows, but presented its data only in bar graphs and similar exhibits. While the amounts in the two columns are not identical, they are so close that total numerical flows have not been an issue.[54]

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[52] Taken from Colo. Exh. 4*, Table 5.8.

[53] Taken from U.S. Exh. 12.

[54] Colorado expert Helton testified that these Colorado data from Colorado Exhibit 4*, Table 5.8, were not in question, and Kansas never disputed this claim. The differences may result from the use of slightly different periods of time.

YEAR	COLORADO DATA	KANSAS DATA
1950	193214	
1951	278941	278854
1952	107524	107050
1953	99354	99355
1954	102055	102147
1955	155009	155021
1956	97596	97405
1957	178131	178106
1958	164122	164112
1959	199460	199340
1960	125301	124862
1961	105791	105715
1962	124762	124872
1963	67709	67726
1964	81340	81155
1965	749070	749058
1966	277191	277151
1967	216221	216372
1968	114824	114480
1969	143634	143650
1970	140272	140290
1971	113502	113622
1972	117682	117409
1973	118007	118120
1974	61709	61814
1975	44454	44417
1976	32363	32250
1977	30745	30756
1978	43486	43547
1979	19805	19775
1980	127174	127148
1981	63569	63575
1982	82224	82101
1983	166953	166889

1984	197299	196905
1985	245354	245335
	Average 1950-85: 144051	Average 1951-85: 142582

A. Precompact Flows.

There is no doubt that Stateline flows in the postcompact years have averaged less than the flows in earlier years. During the compact negotiations, the engineering committee used the period of 1908-42 for the collection and analysis of data. Stateline flows during that period averaged 280,800 acre-feet annually. Jt. Exh. 5, Table D, at 16. Even during the dry period of 1931-40, Stateline flows averaged 146,200 acre-feet annually, thus exceeding the postcompact period, which includes some very wet years. *Id*. The 1944 proposal by Chief Engineer Patterson of the Colorado Water Conservation Board was based upon average flows for 1908-38 amounting to 260,700 acre-feet annually. Jt. Exh. 8 at 22. The 1968 W. W. Wheeler Report authorized by the Colorado legislature puts average Stateline flows for 1924-41 at 194,250 acre-feet per year, and for 1943-50 at 237,160 acre-feet. Jt. Exh. 92 at 14-15. This report carefully eliminated from its averages the enormous flows of 1942 which amounted to 1,317,590 acre-feet. *Id*. at 14, 17. The 1975 report prepared by the Colorado state engineer showed average Stateline flow for 1935-50 of 280,900 acre-feet per year. Jt. Exh. 94 at 49. In short, all of the studies of precompact flows showed amounts that were substantially greater than those occurring during the postcompact period.

A simple comparison, however, between precompact and postcompact flows can be misleading. John Martin Reservoir must be taken into account. That reservoir went into operation just before the compact was finalized, and it was always known and intended that John Martin would alter the regimen of river flows. The conservation pool was specifically designed to store flows that otherwise would have reached the Stateline but would have been unusable. It was well understood that under the compact Colorado would receive roughly 60 percent of the conserved water, with the remainder being available for use in Kansas.

The issue now, however, is whether the reduction of flow into Kansas has been greater than it should have been, or more precisely, whether activities in Colorado have caused a material depletion of usable Stateline flows.

B. Postcompact Depletions.

Colorado has never denied the fact that postcompact flows at the Stateline have declined.[55] Even apart from comparisons with earlier years such as 1908-42, it is evident that Stateline flows have declined since the adoption of the compact. Looking at the early postcompact years from 1950-64, Stateline flows averaged 138,687 acre-feet annually.[56] While in the later 1966-85 period, the average fell to 117,823 acre-feet per year, or a loss of almost 21,000

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[55] See, e.g., RT Vol. 114 at 115-116.

[56] Computed from Colorado Exhibit 4*, Table 5.8, and the table set forth above.

acre-feet annually. (In this comparison I have simply omitted the flood year of 1965 because of its abnormal flows of 749,070 acre-feet.)

Colorado takes issue with Kansas, however, over the causes of the decline. Colorado's expert Duane D. Helton[57] testified that the depletion has been the result of a combination of causes: decreased flow from the tributaries, increased use by phreatophytes, and "partly" from well pumping. RT Vol. 114 at 116. Colorado's state engineer also acknowledged that the 76 wells constructed after 1965 in the Buffalo Canal area depleted Stateline flows. RT Vol. 77 at 23-26; see also Miles testimony, RT Vol. 66 at 47. However, trying to calculate what usable Stateline flows would have been in the absence of the compact violations alleged by Kansas (namely, postcompact pumping in Colorado and the WWSP) is a most formidable task.

Both states used computer models in an effort to isolate the impacts of postcompact well pumping and of the Winter Water Storage Program. Helton agreed there was a trend of increase in depletions of Stateline flows as a result of higher pumping, and that the highest depletions occurred in the mid- to late 1970s. RT Vol. 133 at 57-58. This evidence is discussed at length in Sections

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[57] Mr. Helton was one of Colorado's principal expert witnesses. He holds a master's degree in water resources engineering from the University of Colorado, and worked for 11 years as an engineer with the Colorado Water Conservation Board. Since 1982 he has been with Tipton and Kalmbach, Inc. of Denver, and is now vice president of that firm and chief of its water rights section. Probably no witness was more knowledgeable about all facets of the Arkansas River than Mr. Helton.

XVIII, XIX and XX. However, Colorado asserts certain legal defenses which first need to be addressed. Colorado argues (a) that Kansas should be barred by laches from asserting any claims for well pumping which occurred prior to 1965, and (b) that the impact from pumping below John Martin Reservoir should be offset by benefits to Kansas resulting from the 1980 Operating plan. As part of the argument on the Draft Report, alternate modifications to both of these positions were put forward. These two issues are next analyzed.

SECTION XIII

EQUITABLE DEFENSES

A. Colorado's Claim.

In its Answer to Kansas' First Amended Complaint, Colorado raised affirmative defenses of laches, estoppel, waiver and unclean hands. In Colorado's post-trial briefs, acquiescence was added. However, Colorado states that it has not tried to "pigeonhole" Kansas' actions under any of these labels. Colo. Closing Well Br. at 44. Rather Colorado has focused on those factors which traditionally have been considered by courts of equity in rendering judgments. To that end, Colorado argues that Kansas should be barred from complaining about the effects of well development that occurred prior to 1965. It is undisputed, Colorado asserts, that Kansas did not complain about well development in Colorado until 1985, although the facts had been common knowledge since at least the mid-1960s.

In the alternative, Colorado asserts that Kansas' delay must "gravely add to the burden [it] would otherwise bear, and must be weighed in estimating the equities of the case." Colo. Closing Well Br. at 49, quoting from *Colorado v. Kansas*, 320 U.S. 383 at 394.

As part of the argument on the Draft Report, Colorado urged an alternate approach to laches that "would produce a fairer result." Colo. Oral Argument Memorandum at 2. Instead of aiming at well construction, Colorado suggested that the focus be on well pumping, and that such pumping be treated in the nature of a continuing nuisance. *Id.* at 4. Viewed in that light, Colorado

argued that laches might bar damages for pumping through the mid-1970s, which had occurred without complaint, but not the "increased well pumping which occurred in later years." *Id.* at 4-5. To accept this argument, Colorado stated, would not produce a bar to any prospective remedy. RT Vol. 142 at 110.

Colorado initially alleged prejudice in two respects. First, that Kansas' failure to complain in a timely fashion has made it difficult for Colorado to defend itself and to determine key factual issues because of a lack of data from the early years. Colorado points particularly to the lack of data on groundwater pumping and water levels before 1965, the amount of inflow from ungaged tributaries, and the flows passing Garden City from 1970-85. However, I doubt that complaints from Kansas realistically would have made any difference in Colorado's data collection system. I note that the 1968 W. W. Wheeler Report which was authorized by the Colorado legislature recommended that "Accurate and continuous discharge records be obtained of major tributary inflow," and that "Recorders be installed on all wells." Jt. Exh. 92 at vii. Yet nothing substantial was done. Indeed, these recommendations still have not been implemented.

Insofar as Colorado complains about a lack of data for the early years, it should also be remembered that before 1965 Colorado had no administrative system for the regulation of wells. Moreover, it was not until 1957 that any kind of well registration system was enacted. Prior to that date, wells could be and were constructed without the knowledge of the state. And even after 1957,

the issuance of a well permit was a ministerial act without consideration of any impact on prior vested rights. RT Vol. 76 at 25, 106.

Colorado's second claim of prejudice is that Kansas allowed a valuable economy to develop based on the use of irrigation wells to supplement surface supplies. Without complaint from Kansas for more than twenty years, Colorado alleges, investments were made to construct wells, install pumps, line farm ditches, and level land based on the use of irrigation wells. (This claim is dealt with in Section C.2 below.)

With respect to a bar against damages for pumping before the mid-1970s, Colorado argues that Kansas' failure to complain allowed Colorado to act in a way thought to be acceptable, in essence depriving Colorado of the opportunity to mitigate damages. RT Vol. 142 at 110-11.

B. The Availability of Equitable Defenses as a Matter of Law.

Kansas contends that laches is not applicable in this type of case. Laches is of course a doctrine of equity jurisprudence. It is well recognized that this defense requires more than mere delay; there must also exist some prejudice to the other party which has resulted from the delay, so that it would be unfair – inequitable – to allow the claim. See *Tustin Community Hospital, Inc. v. Santa Ana Community Hospital Ass'n.*, 89 Cal.App.3d 889, 895-96, 153 Cal.Rptr. 76, 80-81 (1979); 30A CJS 353 (Equity § 129): "Laches is such delay in enforcing one's rights as works disadvantage to another." Later in this report the

question whether there has been such prejudice is discussed, but first it is appropriate to consider whether laches is available to Colorado at all.

No interstate compact enforcement case has been found in which the Supreme Court has directly held that laches does or does not apply. One of the arguments in favor of the applicability of laches is based on the fact that the Court has described its jurisdiction in these cases as "basically equitable in nature." *Ohio v. Kentucky*, 410 U.S. 641, 648, 35 L.Ed.2d 560, 567, 93 S.Ct. 1178 (1973). But there is a major exception to the applicability of laches, even in equity cases; it is generally held not to apply against a public agency. *Utah Power and Light Co. v. United States*, 243 U.S. 389, 409, 61 L.Ed. 791, 818, 37 S.Ct. 387 (1917); 30A CJS 358 (Equity § 131). This is especially true of disputes at the state or national level. *Utah Power and Light Co. v. United States, supra*, 243 U.S. at 409, 61 L.Ed. at 818; *Illinois v. Kentucky*, 500 U.S. 380, 114 L.Ed.2d 420, 430, 111 S.Ct. 1877 (1991). The rationale is often said to be that the public interest should not be penalized by the inattention of public officers. Although there are decisions allowing laches against public interests, especially in cases involving municipal corporations or administrative agencies, or where exceptional prejudice is involved (30A CJS 358 [Equity § 131]), it continues to be the rule that states are generally exempt. *Id.*

It would be a mistake, however, to decide the issue solely on the basis of conventional equity rules. In establishing the Supreme Court's original jurisdiction over litigation between states, the constitution does not speak of "cases in law or equity," as it does in certain other situations. Rather it refers simply to "controversies"

between states. Commentary on the difference between cases and controversies has been inconsistent and inconclusive (see 36 CJS 20 [Federal Courts § 1]; 1A CJS 302, 315, 316 [Actions §§ 1, 5c, 6]), but the constitutional language does suggest that the interstate jurisdiction is not necessarily locked into rules of either common law or equity. And in exercising this "unprecedented" grant of judicial power (Charles Warren, "The Supreme Court and Sovereign States," [Stafford Little Lectures for 1924], Princeton Univ. Press, p. 32), the Court has treated it as sui generis – a substitute for the treaty and war powers which the states surrendered when the constitution was established. *Rhode Island v. Massachusetts*, 37 U.S. (12 Pet.) 657, 725, 9 L.Ed. 1233, 1260 (1838); *Kansas v. Colorado*, 185 U.S. 125, 140, 46 L.Ed. 838, 844, 22 S.Ct. 552 (1902); *North Dakota v. Minnesota*, 263 U.S. 365, 372-73, 68 L.Ed. 342, 345, 44 S.Ct. 138 (1923); *Idaho v. Oregon*, 462 U.S. 1017, 1031, note 1, 77 L.Ed.2d 387, 400, 103 S.Ct. 2817 (1983).

As Chief Justice Taney explained in 1855, traditional chancery practice is an "analogy" in these cases but is not controlling. *Florida v. Georgia*, 58 U.S. (17 How.) 478, 492, 15 L.Ed. 181, 189 (1855). Thus viewed, the inquiry really is one of fundamental justice rather than what is the historical or even the current practice of courts exercising less extraordinary powers. It is in this sense that the Court has observed that proceedings under its original jurisdiction are "basically" equitable in nature. *Ohio v. Kentucky, supra*, 410 U.S. at 648, 35 L.Ed.2d at 567, 93 S.Ct. 1178 (1973).

The Supreme Court has referred to a broad policy in interstate boundary disputes disfavoring the untimely assertion of rights (see *Illinois v. Kentucky, supra*, 500 U.S.

at 388, 114 L.Ed.2d at 431, 111 S.Ct. at 1883 (1991)), but that policy has been asserted in other situations as well. Thus, in a nuisance action involving sewage contamination of the Mississippi River, Justice Holmes observed that it would be "contradicting a fundamental principle of human nature to allow no effect to the lapse of time, however long." *Missouri v. Illinois*, 200 U.S. 496, 520, 50 L.Ed. 572, 578, 26 S.Ct. 268 (1906). And, as noted above, the Court held in *Colorado v. Kansas*, 320 U.S. 383, 394, 88 L.Ed. 116, 124, 64 S.Ct. 176 (1943), that Colorado's improvements and Kansas' inaction in the twenty-one years following the 1907 Arkansas River decision "gravely add to the burden [Kansas] would otherwise bear and must be weighed in estimating the equities of the case." See also *Washington v. Oregon*, 297 U.S. 517, 528, 80 L.Ed. 837, 843, 56 S.Ct. 540 (1936). Clearly, although it is not based on equity jurisprudence as such, the rule to be followed here is that there is some point at which unexcused delay by a state in connection with an interstate apportionment will work to bar relief.

In applying such a principle, it should be borne in mind that no statute of limitations is applicable in this case, and therefore there is no outside limit to the period during which delay will be tolerated. The test should not be any particular number of years, but rather the degree of prejudice to the state claiming laches. *Tustin Com. Hosp. v. Santa Ana Com. Hosp., supra*, 89 Cal.App.3d at 895-96, 153 Cal.Rptr. at 80-81; 30A CJS 353 (Equity § 129).

C. The Facts Do Not Support a Claim of Laches or Other Equitable Defense.

Colorado seeks to bar relief based upon impacts from wells drilled before 1965. This would include almost all of the wells in existence in 1985. According to Colorado's own data, in 1985 there were 2062 large irrigation wells with a capacity of 100 gpm or more. Colo. Exh. 165*, Table A.1. Of that total, 1842 were in existence before 1965. *Id.* According to Colorado, Kansas did not register any formal complaint until 1985. Colo. Closing Well Br. at 13, 44; RT Vol. 78 at 109; RT Vol. 115 at 63-64. This assertion is essentially correct.

1. The Timing of Kansas' First Complaint Against Pumping.

On March 28, 1985, at the instance of Kansas, the compact administration pursuant to Article VIII-H undertook a formal investigation of compact violations alleged by Kansas. Included in the investigation were the issues of whether "well development of the waters of the Arkansas River in Colorado," and the operation of the Winter Water Storage Program had caused a material depletion in river flows. Jt. Exh. 28. In late 1983 Kansas had undertaken its own study of Stateline depletions through the firm of Simons, Li & Associates. The actual work was done largely by Brent E. Spronk and Dale E. Book, both of whom later became principal witnesses for Kansas at the trial. The Simons, Li report was completed in February, 1984 and made available to the compact administration. Jt. Exh. 19, Minutes of 3-28-85 at 99-100. That study concluded that a conservative estimate of

Stateline depletions due to postcompact wells for the 1974-81 period was between 40,000 and 50,000 acre-feet per year. Jt. Exh. 88 at v. Prior to this time, however, the records of the compact administration reflect very little about the impact of postcompact well development in Colorado.

The minutes of December 14, 1976 include a brief remark from a member of the audience. Stating that 25 additional wells were being put in along the Kansas line, he commented, "so I don't know whether you are ever going to get any water to the Kansas line again or not." Jt. Exh. 19, Minutes of 12-14-76 at 74.

The first extensive consideration of pumping impact shows up in the minutes of April 23, 1977. And then it came not from Kansas but rather from Harry L. Bates, one of the compact commissioners from Colorado. Bates represented Water District 67, the area downstream of John Martin Reservoir, which of course has some interests similar to those of Kansas. He submitted an "Historical Data" report which compared two ten-year periods of postcompact operations. Jt. Exh. 19, Minutes of 4-23-77 at 39-50. The report concluded that average storage in John Martin Reservoir had declined by more than 54,000 acre-feet annually, and that the decline could not be explained by weather changes. The four causes which, "in bitter fact," had caused the depletion were listed as: a heavy increase in upstream winter irrigation; a "proliferation of wells pumping from the aquifer hydraulically connected to the live river stream above John Martin"; the transfer of some agricultural rights to municipal and industrial

use; and the re-regulation of river flow by Pueblo Reservoir. Jt. Exh. 19, Minutes of 4-23-77, Historical Data report.

Bates' report was taken up again at the December 13, 1977 meeting, but nothing appears to have come of it. The comment was made at that meeting that most of the items in the report were either outside of the compact administration's jurisdiction, or were before the courts, or were being studied and resolved by other authoritative agencies. Jt. Exh. 19, Minutes of December 13, 1977, at 6. The compact leaves the primary administration of water rights with the states. Article VI-A(2).

There was also discussion of a pending agreement between the City of Lamar and Iowa Beef Producers, Inc. for the purchase of land and water rights in the Lamar area. The minutes state:

> "The Compact Administration was concerned that there might be more wells drilled and thus further deplete the river water." Jt. Exh. 19, Minutes of 12-12-78 at 8.

In regard to possible supplemental wells, the minutes reflect an explanation that "applications would have to be made to the Water Court for permit of augmentation" and that the division engineer did not anticipate any new wells being drilled. *Id.*

With these exceptions, I have found nothing in the record of the compact administration proceedings from 1950 to 1985 that reflects any complaint by Kansas about pumping in Colorado. The record supports Colorado's assertion that no formal complaint to the compact administration, or indeed to any appropriate Colorado officials,

was made before 1984 (if the Simons, Li report is considered as such) or otherwise before 1985, when Kansas asked the compact administration to undertake an Article VIII-H investigation.

2. The Need to Show Prejudice.

Laches does not result merely from the passage of time. The defendant must be prejudiced by the delay. *Gardner v. Panama Railroad*, 342 U.S. 29, 96 L.Ed. 31, 72 S.Ct. 12 (1951); *Southern Pacific Co. v. Bogert*, 250 U.S. 483, 63 L.Ed. 1099, 39 S.Ct. 533 (1919); *Russell v. Todd*, 309 U.S. 280, 84 L.Ed. 754, 60 S.Ct. 527 (1940). Here the farmers in Colorado after 1950 drilled new wells and expanded the use of older wells without the official knowledge of either Colorado or Kansas. They relied upon Colorado law as it then existed, not upon inaction by Kansas. Prior to 1957 a well could be drilled in Colorado without any state permit, and without the knowledge of the state. Colorado did not even begin to collect well data until 1957. RT Vol. 76 at 101. Even then, it had no program for reporting or determining the amount of water pumped. In *Kuiper v. Atchison, Topeka & Santa Fe Ry. Co.*, 195 Colo. 557, 581 P.2d 293 (1978), the Supreme Court of Colorado stated:

> "Prior to the adoption of the 1973 Rules, there had been virtually no regulation of wells in the basin, and consequently no empirical data as to the effect upon surface rights in the basin of regulation of wells." Colo. Exh. 387 at 296.

There is no evidence in the record that Kansas knew, or should have known, of the extent of postcompact well pumping in Colorado until virtually all of the additional

wells had been constructed. Nor is there any evidence that farmers in Colorado knew that Kansas had any interests that might be affected by their pumping. Under Colorado statutes (apart from any consideration of the compact) their well development was lawful. The construction of new wells and the increase in pumping did not occur because Kansas failed to complain, but rather because of the economic value of wells to the Colorado farmers, and the fact that such wells were not wrongful under Colorado law. Wells, in and of themselves, do not violate the compact.

Once the farmers in Colorado, relying upon Colorado law, had made those well investments, the passage of time would not create prejudice. On the contrary, delay or inaction by Colorado or Kansas in bringing about well regulation permitted the benefits of those wells to be increasingly enjoyed and such investments amortized.

Insofar as Colorado further claims prejudice because of the lack of data from the precompact or early postcompact years, I find that such data was simply not being collected at that time. The lack of data suggests that neither state could be expected to have been aware of the effect of pumping. Kansas also makes the point with some merit that the Colorado experts testifying to such pumping did not make any serious complaint about the lack of pre-1965 data. Colo. Exh. 165*; RT Vol. 69 at 51-54; RT Vol. 71 at 5-142; RT Vol. 72 at 4-131; RT Vol. 114 at 19-22, 28, 39. To be sure, power records for 1940-60 were incomplete, and this made the task of estimating pumping more difficult; but missing years were accounted for by using regression techniques, and Helton testified that

Colorado's ultimate pumping estimates were reasonable. Colo. Exh. 165* at 3; RT Vol. 115 at 58.

During the period from 1963 to 1968, the USGS made a "comprehensive evaluation" of the hydrology of the Arkansas River Valley in Colorado. Jt. Exh. 66 at 1. The purpose of the study was "to provide basic information to water users and State and local agencies for the planning, management, and administration of the water resources." *Id.* An actual field inventory of all large scale irrigation wells was conducted. The report, published in 1970 as "Basic-Data Release No. 21," included location maps of wells, the saturated thickness of valley-fill deposits, water level measurements, well records, chemical analyses of water from selected wells, pump data, and pumping estimates over the years beginning in 1940. Certainly the USGS used and collected all the data then reasonably available. If Colorado has suffered any prejudice because of data missing prior to 1963, it is not because Kansas failed to complain about pumping, but simply because the data were not kept. Colorado, however, says the issue is not what data were being collected, but what evidence "would have been available" if a timely complaint had been made. Colo. Oral Argument Memorandum at 16. This argument presupposes that Colorado, in essence, would have done earlier what the USGS did between 1963 and 1968 – a highly speculative assumption.

Colorado also argues that it has been deprived of the testimony of "highly knowledgeable" witnesses who could prove that Kansas acquiesced in upstream well development. Colo. Oral Argument Memorandum at 12. Colorado refers to George Knapp, William Leavitt,

Roland H. Tate and R.V. Smrha who were Kansas' early representatives to the compact administration. All except Smrha died between 1964 and 1967. If the issue involved compact interpretation, the testimony of these leading figures might indeed be useful. But there is no evidence to suggest that these men acquiesced in compact violations. The records of the compact administration are completely devoid of any reference to well pumping in Colorado during this period of time.

3. The Issue of Common Knowledge.

Colorado argues that the facts concerning well development in Colorado were open, notorious and of common knowledge, and that Kansas should have been on notice of the potential impact by the mid-1960s, if not earlier. Colo. Closing Well Br. at 14, 45; Colo. Reply Br. at 8. Colorado cites several reports, two Colorado Supreme Court decisions, and the state's controversial efforts to regulate wells. Jt. Exhs. 66, 78, 91, 92, 94; Colo. Exhs. 384, 387.

Colorado's efforts to regulate wells began in 1965 with enactment of a statute directing the state engineer to administer wells within the priority system. Colo. Exh. 378. The state engineer's initial effort to shut down 39 wells under that statute was set aside in 1968 by the Colorado Supreme Court. Colo. Exh. 384. Neither the 1965 legislation, nor the Court decision, dealt with depletions of flow into Kansas. At the direction of the Colorado legislature, the Wheeler Report was published in 1968. Jt. Exh. 92. That report estimated pumping between 1940 and 1965, showing an increase from 2300 acre-feet in 1940

to a 1960-64 average of 168,200 acre-feet. Jt. Exh. 92 at 22. The report seems to indicate that pumping in the order of 114,000 acre-feet annually would not interfere with an average demand by Kansas during 1951-64 of 42,000 acre-feet per year. *Id.* at 23.

In 1970 the USGS published a comprehensive report on wells along the Arkansas River between Pueblo and the Stateline. Jt. Exh. 66. It found that the groundwater supply was developed mainly from 1950 to 1965 when approximately 1000 large-capacity irrigation wells were drilled. *Id.* at 5. The report estimated that pumping increased from 31,000 acre-feet to 185,000 acre-feet annually in the period 1950 to 1965. *Id.* However, the impact on streamflow was not studied.

Another USGS report was published in 1974. Jt. Exh. 78. This report published the results of a mathematical model simulating the stream-aquifer system of the Arkansas River from Pueblo to the Stateline. While Colorado experts at the trial were critical of the accuracy of this model, it nonetheless simulated Stateline depletions due to well pumping in Colorado during the 1941-65 period of 67,000 acre-feet annually. Jt. Exh. 78, Table 2, compare No. 1 with No. 14; RT Vol. 99 at 56-57.

In 1972 the Colorado state engineer issued regulations limiting pumping to three days a week unless a written plan were approved to protect prior vested rights. Jt. Exh. 93 at 2. Subsequent regulations to curtail all pumping that was not under an approved plan were struck down in 1978 by the Colorado Supreme Court. Colo. Exh. 387; *Kuiper v. Atchison, Topeka & Santa Fe Ry. Co.*, 195 Colo. 557, 581 P.2d 293 (1978). The Court in that

decision acknowledged evidence that pumping exceeded 200,000 acre-feet in 1972, but noted that "the restriction of wells does not necessarily result in a comparable increase in the supply of surface water." *Id.* at 295.

In support of these tighter regulations, the Colorado state engineer prepared a report in 1975. Jt. Exh. 94. He concluded that the rapid growth of irrigation wells during the period from the late 1940s to the early 1960s had decreased the amount of river water available for surface water appropriators, and had deprived senior water users of a portion of their lawful supply. *Id.* at 1, 53. He quantified the reduction for the period 1965-72 at an average of 112,800 acre-feet per year, but testified later during the trial of this case that such reduction would not translate directly into Stateline depletions. *Id.* at 53; RT Vol. 78 at 85.

None of these reports or court decisions deal with the issue of impact on usable flow at the Stateline. Yet wells *per se* are not wrongful under the compact. Only if they cause a material depletion in usable flows would they be in violation. Determining what flows are usable, and the depletions of usable flow in contrast to depletions of total flow, is not simple. In fact, one of Colorado's experts testified that "surplus" water was available through the 1950s and 1960s, and at least during that period there was little impact on usable flows from upstream well development. RT Vol. 115 at 62-64. Moreover, in his opinion, the only feasible way to develop the unused waters of the Arkansas River was through wells, "and that is what both States did." RT Vol. 86 at 78-79; Colo. Closing Well Br. at 22. Apparently the Colorado state engineer continued to grant well permits downstream from John Martin during

the 1970s because he also thought that unappropriated water was still available and Kansas would not be adversely impacted. RT Vol. 76 at 112-115; RT Vol. 81 at 156. However, Danielson, the next state engineer, ceased issuing such permits in 1979 because he believed that further appropriation without a replacement or augmentation plan would cause injury. RT Vol. 76 at 116.

The regulations adopted by the state engineer for the control of wells in Colorado were intended to protect surface water users in Colorado, not flows into Kansas. RT Vol. 76 at 117-120. The state engineer was under a specific statutory duty to make and enforce such regulations as would enable the State of Colorado to meet its compact commitments. C.R.S. § 37-80-104. However, Dr. Danielson said that no such rules had ever been prepared for the Arkansas River "because it was never determined necessary to define an intrastate administrative scheme to meet that obligation." RT Vol. 76 at 86, 120.

Isolating the impacts of wells on usable Stateline flow was made all the more difficult because of other changing conditions during the 1970s and early 1980s. The 1970s were generally dry years and some reduction in flow was to have been expected. Pueblo Dam came on line in 1976 and began to reregulate native flows. Transmountain imports increased, which to some extent provided an offset to pumping. The 1980 Operating Plan was placed into effect, which Colorado alleges offset the impacts of increased pumping downstream from John Martin Reservoir. The Winter Water Storage Program was instituted. Moreover, there was no quantitative or specific entitlement against which depletions to usable flow could be

judged. Nor were there any agreed upon criteria for establishing what flows were usable.

Indeed, as late as 1985, a key Colorado representative took the view that acknowledged declines in usable Stateline flows were not caused by pumping, but rather appeared to result from other factors. In a report dated October 4, 1985, made to the compact administration pursuant to its Article VIII-H investigation, J. William McDonald, one of the Colorado compact commissioners, acknowledged that there had been "a substantial decline in usable stateline flows starting in 1974." Jt. Exh. 32 at 4. However, he concluded that the decline "was directly related to a decline in tributary inflow from plains drainage areas, combined with below-average flows at Las Animas." *Id.* at 5, 9, 12, 19. He refused to permit a compact administration investigation of well development in Colorado "when the single and double-mass diagrams do not suggest that well development in Colorado has had an impact on usable stateline flows." *Id.* at 23. McDonald did not agree with the conclusions in Kansas' report on well pumping. Jt. Exh. 31 at 33-34. Kansas argues that neither state was actually aware that well pumping was causing material depletions of usable flow at the Stateline until the compact administration investigation in 1985. RT Vol. 142 at 128-29.

Colorado also relies upon the depositions of three Kansas officials to demonstrate that Kansas was on notice of the well development in Colorado. These officials were Carl Bentrup, a Kansas representative to the compact administration for more than thirty years; Guy Gibson, employed by the Kansas Division of Water Resources for forty-three years and serving as chief engineer for eleven

years before his retirement in 1983; and Howard Corrigan, the former Kansas water commissioner of the Garden City field office. Their depositions, which were introduced into evidence, show that these men were aware of some well development in Colorado, and that some informal discussions occurred within the compact administration. However, the evidence is sketchy and does not demonstrate that these officials were aware of the number of wells, the extent of Colorado's pumping, or the impact or even potential impact of pumping on usable Stateline flows. Colorado frequently refers to "well development," but that alone does not violate the compact.

D. Application of an Equitable Statute of Limitations.

During argument on my Draft Report, Colorado presented a "slightly different twist" to the application of laches. RT Vol. 142 at 100. Colorado argued that Kansas had not complained about pumping until 1984 or 1985; that in the early postcompact years, Colorado was not aware there was a problem, and had acted in good faith; and that it is fundamentally unfair under those circumstances to permit Kansas to reach back to 1950 for its damages, either in water or in money. RT Vol. 142 at 110-11, 117, 149. Colorado urges that I "strongly consider imposing an equitable statute of limitations,[58] so that we

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[58] Colorado was not aware of any applicable federal statute of limitations, nor am I. RT Vol. 142 at 118.

are not in a position of paying for sins that weren't sins." RT Vol. 142 at 118.

Colorado also accuses Kansas of sleeping on its rights, saying that is the issue. RT Vol. 143 at 52; RT Vol. 142 at 110. This latter argument, however, seems to undercut Colorado's reliance on its own good faith. At least, Colorado's argument requires that Kansas recognize a potential compact violation while Colorado is excused.

In any event, Kansas relies upon *Texas v. New Mexico*, 482 U.S. 124, 96 L.Ed. 2d 105, 107 S.Ct. 2279 (1987) for the proposition that acting in good faith does not excuse a compact violation. There, the Court stated at page 129:

> "But good-faith differences about the scope of contractual undertakings do not relieve either party from performance. A court should provide a remedy if the parties intended to make a contract and the contract's terms provide a sufficiently certain basis for determining both that a breach has in fact occurred and the nature of the remedy called for. Restatement (Second) of Contracts § 33(2), and Comment b (1981). There is often a retroactive impact when courts resolve contract disputes about the scope of a promisor's undertaking; parties must perform today or pay damages for what a court decides they promised to do yesterday and did not. In our view, New Mexico cannot escape liability for what has been adjudicated to be past failures to perform its duties under the Compact."

In *Texas v. New Mexico* the Court upheld a total shortfall of 340,100 acre-feet that had accumulated over the period 1950-83, and permitted money or water damages

for that amount. 482 U.S. at 127-28. Under a compact signed in 1948, New Mexico was barred from depleting the flow of the Pecos River at the New Mexico-Texas border below that which was available to Texas under 1947 conditions. An engineering advisory committee drafted an Inflow-Outflow Manual to determine how much water Texas should expect to receive over any particular period for any particular levels of precipitation, under the consumption conditions prevailing in New Mexico in 1947. However, it became clear "soon after the Compact went into effect" that the Inflow-Outflow Manual did not describe the actual state of the river. *Texas v. New Mexico*, 462 U.S. 554, 560, 77 L.Ed. 2d 1, 103 S.Ct. 2558 (1983). In almost every year following adoption of the Compact, flows at the state line were significantly less than the levels predicted by the Manual, with no obvious changes in either natural conditions or uses in New Mexico.[59] As a result, the basic meaning of the 1947 condition was not defined until 1979, and a workable methodology for translating New Mexico's obligation into quantities of water was not achieved until 1984, in the course of the litigation between the states. The Master reported in 1982 that New Mexico's obligation "is still uncertain," and that New Mexico "had acted in good faith." *Texas v. New Mexico*, 482 U.S. 124, 129, 96 L.Ed. 2d 105, 107 S.Ct. 2279 (1987). Nonetheless, when the obligation was finally determined, the shortfall was assessed back to 1950.

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[59] The Inflow-Outflow Manual proved to be so faulty as to be unusable.

Colorado attempts to distinguish these Pecos River decisions, arguing that between Texas and New Mexico there had been "an ongoing and consistent pattern of ignored complaint." RT Vol. 142 at 110. This appears to be somewhat of an overstatement. For the first 15 years the Pecos River Commission[60] functioned in "apparent harmony," albeit under a tacit agreement to defer the problem of determining the required flows at the state line. *Texas v. New Mexico*, 462 U.S. 554, 560, 77 L.Ed.2d 1, 103 S.Ct. 2558 (1983). The dispute surfaced sometime after 1962 and came to a head in 1970. *Id.* at 561. Texas invoked the original jurisdiction of the Supreme Court in 1974. *Id.* at 562. While there is no indication that laches was raised in the *Texas v. New Mexico* litigation,[61] the Court's decisions there seem to militate against Colorado's theory of an equitable statute of limitations.

In the final analysis, however, statutes of limitation are not a truly appropriate analogy to the argument Colorado now makes. Such statutes are characterized by the specificity of their terms and the rigidity with which they tend to be applied. Laches, on the other hand, can be as flexible as the circumstances of each particular case require. Although, as already noted, various rules are ordinarily followed in applying laches, it is after all simply a tool of equity in the task of reaching a fair decision.

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[60] Comparable to the Arkansas River Compact Administration.

[61] New Mexico argued that this Court could require only the future performance of compact obligations, without any remedy for past breaches. 482 U.S. at 128.

This flexibility is especially present in the original jurisdiction, which follows chancery jurisprudence only as an analogy and which looks ultimately to fundamental principles of justice. *Florida v. Georgia, supra,* 58 U.S. (17 How.) 478, 492, 15 L.Ed. 181, 189 (1855).

Thus, the decision to accept or reject Colorado's request to exclude the early years of excess pumping lies within the sound discretion of the Court. If the Court is inclined to approve any such exclusion, my recommendation is that it should not cover the full 25 years urged by Colorado, but at most should apply only to damages from pumping that occurred before 1965. By 1965, the Colorado legislature was fully alerted to the potential impact of wells on surface flows throughout the state, and acted to require the state engineer to administer underground waters tributary to surface flows in accordance with the priority system. Colo. Exh. 378, C.R.S. § 148-11-22. After that time, the "good faith" underpinning of the Colorado position begins to erode.

Apart from Colorado's present arguments, and apart from any prospective relief, equitable considerations may still be appropriate during the remedy phase of the trial. If the Court upholds my recommendation on liability caused by postcompact pumping, it will be necessary to determine the amount of depletions of usable Stateline flow. The Court's decisions permit a remedy for past shortages either in water or money. With respect to ordering deliveries of water, the Court has stated:

> "To order making up the shortfalls by delivering more water has all the earmarks of specific performance, an equitable remedy that requires

> some attention to the relative benefits and burdens that the parties may enjoy or suffer as compared with a legal remedy in damages. '[S]pecific performance is never demandable as a matter of absolute right, but as one which rests entirely in judicial discretion, to be exercised, it is true, according to the settled principles of equity, but not arbitrarily and capriciously, and always with reference to the facts of the particular case.' Haffner v. Dobrinski, 215 US 446, 450, 54 L Ed 277, 30 S Ct 172 (1910). Specific performance will not be compelled 'if under all the circumstances it would be inequitable to do so.' Wesley v. Eells, 177 US 370, 376, 44 L Ed 810, 20 S Ct 661 (1900)." *Texas v. New Mexico*, 482 US 124, 131, 96 L.Ed. 2d 105, 107 S.Ct. 2279 (1987).

E. Conclusions.

The extent of postcompact well pumping in Colorado was not generally known until approximately 1968, and there is no substantial evidence that Kansas knew or should have known about the effect of such well development before that time. By then, almost all of the wells of which Kansas now complains had been constructed. By the 1970s the extent of pumping in Colorado was a matter of common knowledge, but that is not to say that the impact of such pumping on usable Stateline flows was generally known or understood. Indeed, it appears not to have been, even in Colorado. I do not believe that Colorado officials thought they were sanctioning a compact violation in the well regulations that were established, or in their failure to adopt specific regulations to protect usable Stateline flows, or in the issuance of new well permits.

There is no specific evidence to explain why Kansas did not complain sooner, but Kansas may well have been relying upon the slowly developing regulatory system in Colorado for protection. This program was evolving all through the 1970s, including the promising concept that augmentation of supplies would be required in order to allow pumping. It is true that the implementation of this requirement has proved lacking, but that result could not have been known at the outset. I think that Kansas had a right to rely, at least initially, upon the Colorado efforts to regulate pumping, and the law should not penalize a state under those circumstances. The compact itself states that, except as otherwise provided, nothing shall supplant Colorado's administration of its water supplies. Article VI-A(2). Moreover, equitable defenses should not be applied in ways to encourage or force early litigation between states, particularly when a state is implementing efforts to address the problem.

I conclude, therefore, that Kansas has not been guilty of inexcusable delay in making its well claim, and that Colorado has not been prejudiced by Kansas' failure to press its claim earlier. Kansas should not be barred by laches or any other equitable defense, including acquiescence, from obtaining relief based on its well claim. In reaching these conclusions, I have fully considered the Court's statement in *Colorado v. Kansas*, 320 U.S. 383 at 394, that unjustified delay must "gravely add" to the plaintiff's burden and be weighed in considering the equities of the case.